ROYAL COMMISSION

ON

ELECTRIC POWER PLANNING

CHAIRMAN: ARTHUR PORTER

REPORT ON THE NEED FOR ADDITIONAL BULK POWER FACILITIES IN EASTERN ONTARIO

ISBN-0-7743-4129-7

ROYAL COMMISSION

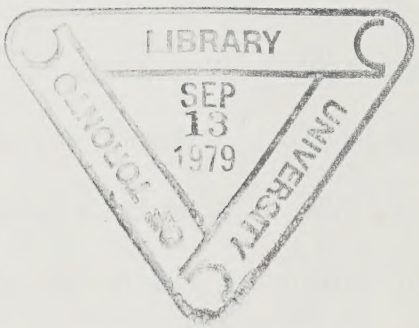
ON

ELECTRIC POWER PLANNING

Arthur Porter, Chairman
Robert E.E. Costello,* Commissioner
George A. McCague, Commissioner
Solange Plourde-Gagnon, Commissioner
William W. Stevenson, Commissioner

Frederick R. Hume, Legal Counsel
Ronald C. Smith, Executive Director

* Resigned on 9 May 1977 due to ill health



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Office of the
Chairman

Royal Commission
on Electric Power
Planning

416/965-2111

7th Floor
14 Carlton Street
Toronto Ontario
M5B 1K5

13 July 1979

The Honourable J.A.C. Auld
Minister of Energy
56 Wellesley Street West
TORONTO, Ontario

Dear Mr. Minister:

Pursuant to Order-in-Council #2065/78 dated 12 July 1978 requesting the Commission to report on the need for additional bulk power facilities in Eastern Ontario, and the Commission having completed these duties, I have pleasure in submitting herewith the said report.

Yours very truly,

Arthur Porter
Chairman

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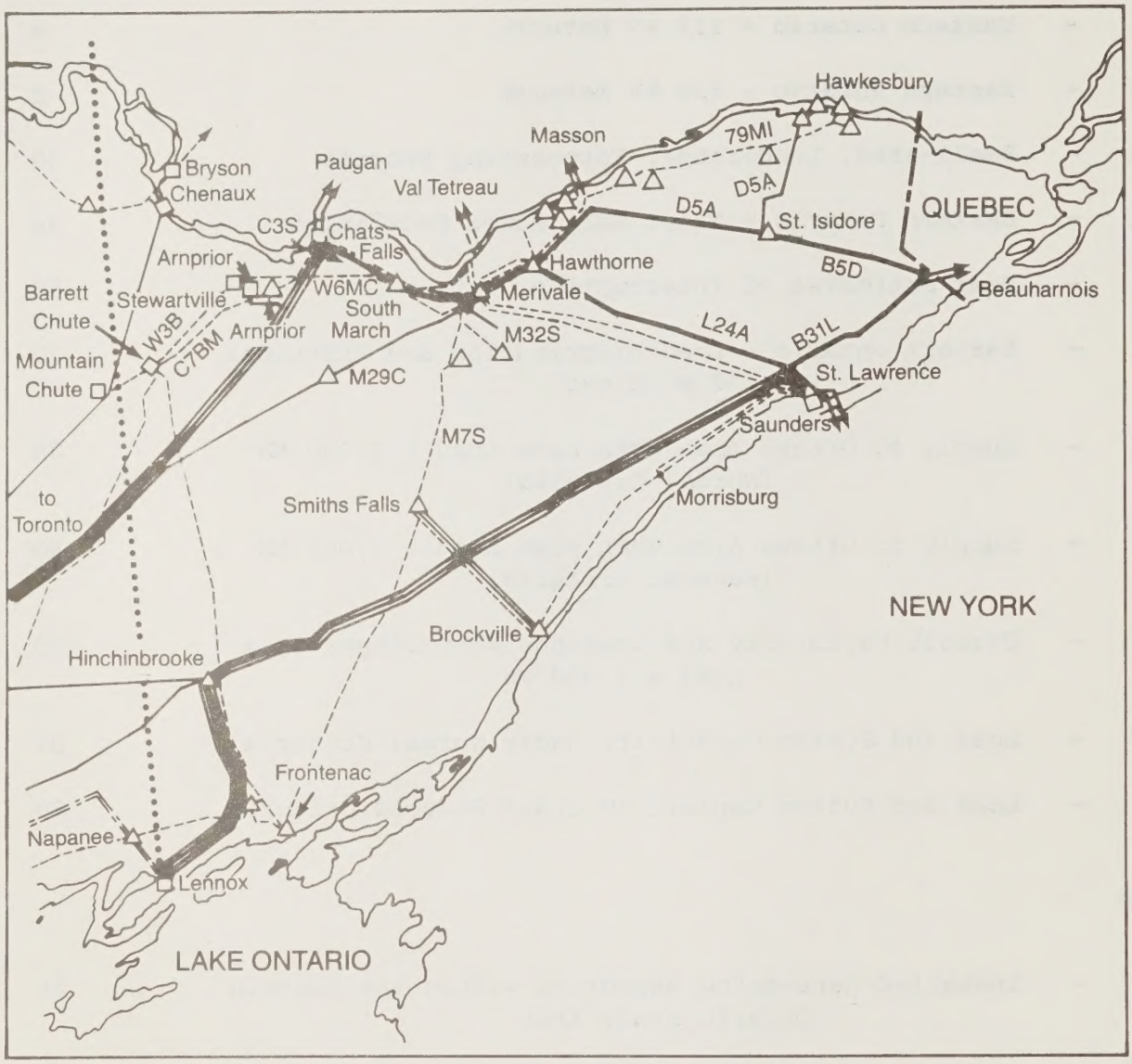

═══ 500 kV circuits

——— 230 kV circuits

– – – – 115 kV circuits

△ transformer stations

□ generating stations

····· study-area boundary

——→ interconnections

——— critical circuits

Source: Ontario Hydro Exhibit SE2

Summary of Conclusions and Recommendations

The Commission was asked to consider and report on the following matters:

- load growth in the Eastern Ontario Region up to the end of 1987 and from 1987 to 2000
- the capability of existing and committed bulk power generation and transmission facilities to supply this load in the region
- the resulting date at which additional bulk power facilities, if any, will be needed.

Lacking the gift of prophecy, or the time to do our own comprehensive appraisal of the prospects for load growth in eastern Ontario (though Section V records our impressions based on the hearings), we will now summarize our views with respect to Ontario Hydro's forecast of the eastern Ontario load and then consider the adequacy of bulk power facilities in the region, the acceptability of power system security without additional facilities, and the merits of strengthened interconnections with neighbouring utilities. Finally we will state our recommendations.

The Load-Forecasting Methodology

As we have already concluded in our "Report on The Need for Bulk Power Facilities in Southwestern Ontario", we find ourselves unable to accept at face value Ontario Hydro's method of forecasting sub-provincial

electrical loads. We are conscious that more work is always needed to perfect the econometric relationships that are properly given great weight by Ontario Hydro in the development of both province-wide and sub-provincial forecasts. But we have concluded that a greater effort should now be made to develop load-forecasting methodologies predicated increasingly on the analysis of patterns in the end uses of electric power. These we regard as particularly valuable in the preparation of sub-provincial load forecasts. Ontario Hydro has taken some steps that are worthy of encouragement e.g. in developing the SRI-CEA model. However, greater efforts should now be made to assess the impacts on load growth, especially at a regional level of conservation practices, of the adoption of efficiency standards for appliances and buildings, and of load management. In the Commission's Final Report, recommendations will be presented with respect to such topics as the encouragement of energy conservation and load management, the development of alternate sources of energy (especially solar and biomass energy), the future role of dual-purpose power production (electric and thermal power), and the enhancement of system resilience by the development of an appropriate mix of generating technologies. Potential developments in these areas will clearly have significant impact on future load growth and on the sizes and types of new generating facilities that will be needed.

Load Growth in Eastern Ontario

During the last two years, the Commission has made an in-depth study of the factors affecting the future demand for electric power in

Ontario. Our findings will be presented in the Final Report. Suffice it to state, at this penultimate stage of the research, that the average projected (compounded) load growth for the whole system to the year 2000 could, in our opinion, drop below the 4 per cent per annum that we suggested in our Interim Report on Nuclear Power. We believe that the evidence put forward by Ontario Hydro does not substantiate the conclusion that the average load growth, either for eastern Ontario as a whole or for the Ottawa area, which was the focus of our concern, is greater than that for the system as a whole. In the circumstances, we feel justified in substituting our own assessment of possible trends in provincial electrical growth, modified by our views of the situation in the Ottawa area, for those provided by Ontario Hydro.

Adequacy of Bulk Power Facilities in Eastern Ontario

Although the peak capacity of generating stations in eastern Ontario (3,769 MW) appears to be adequate to meet Ontario Hydro's forecast load in the area until the mid 1980s, in fact, this is not so. For some years, the region has been a net importer of energy, primarily from Quebec. The reason is that, with the exception of the 734 MW Saunders hydroelectric station on the St. Lawrence River near Cornwall, all the other generation in the area, including the 2,200 MW oil-fired Lennox station near Kingston, is designed for intermediate or peaking duty only. The base load requirements of the area must, therefore, be met in part by generation in central Ontario.

The Commission was urged by two public interest groups in Prescott to investigate the merits of Ontario Hydro's argument that it needed a site for a generation complex in that area. This we have not done for the following reasons; on the basis of its 1979 load forecast, Ontario Hydro will have some 3,400 MW of excess generating capacity in its East System to the mid 1980s; we are confident that permission to construct generating facilities in the area would only be given after full hearings before the Environmental Assessment Board; after a careful review of the evidence, we have come to accept Ontario Hydro's position that it is transmission limitations, not a lack of system generation that will be the first cause of difficulties for Ontario Hydro in supplying the Ottawa area load.

In summary, our key findings with respect to the adequacy of bulk power facilities in eastern Ontario are:

1. At present, the security of supply to the Ottawa area is probably already less than that prevailing in most of the province. This is partly because some transmission lines will be out of service pending the completion of the programme to upgrade critical transmission lines into the Ottawa area involving heavier conductors, higher operating temperatures and more complex controls, which will inevitably lead to a reduction in the ability of these circuits to withstand severe storm conditions. Thus, even when the upgrading programme is completed, there will be a reduced level of reliability of power supply to the Ottawa area.

2. Following full upgrading of critical circuits, the level of Ottawa area load that could be supplied at the normal planning criterion (loss of two lines or other key elements in the transmission system) without automatic reactive power support to maintain voltages at acceptable levels has already been exceeded. (This support may take the form of static shunt capacitors, synchronous condensors, or static compensators). The level of load that could be supplied with full automatic reactive power support would be exceeded in the early 1980s under any annual rate of load growth in excess of 3 per cent. (Ontario Hydro's 1979 load forecast is for 5 per cent growth in the Ottawa area.)

3. Ontario Hydro's evidence,with which we concur, is that 1986 is the earliest date by which major new bulk power transmission facilities could be installed to serve the Ottawa area. Therefore, at any rate of load growth exceeding 3 per cent per annum, the normal delivery capability of the system will be exceeded before new facilities can be provided. Thus, although we believe that Ontario Hydro's 1979 load forecast of 5 per cent will probably prove to be high, we feel that on the basis of any realistic assessment of the prospects for load growth, there are real problems with the supply of power to the Ottawa area.

4. With the reduced planning criterion (loss of only one transmission line into Ottawa), even assuming a 3 per cent load growth, some degree of automatic reactive power support would be required by the

winter of 1982/83. With full automatic reactive power support, Ottawa area loads could theoretically be supplied into the 1990s, but it is our opinion that, because of the great difficulty of remaining within the narrow tolerances that would have to apply to the amount and location of this support, dependence on a system of automatic reactive power support to maintain supply at anywhere near the full level in the Ottawa load area would be imprudent. It should not form part of any normal system supply plan.

5. Without major new transmission facilities, incremental power losses in the bulk power system in eastern Ontario will increase rapidly. For example, a 920 MW growth in load will increase the losses by about 95 MW, which is equivalent to the total output of the Chats Falls Generating Station. New transmission facilities could save up to $18 million (in 1988 dollars) annually by 1988 in energy losses avoided.

6. There are hydraulic stations upstream on the Ottawa River (Chenaux, Des Joachims, and Otto Holden) and on the Madawaska River (Mountain Chute) that are not directly connected to the Ottawa area load. It is conceivable that it be found desirable in the future to utilize this generation to supply loads in the Ottawa area, but major new transmission facilities would be required to accomplish this. However, as this falls into the area of "solutions" to the limitations on the capability of supply to the Ottawa area, the Commission sought no evidence on the matter.

7. Ontario Hydro has identified 40 potential new hydroelectric sites across the province, of which 17 are considered to be relatively favourable for development in this century. However, the sites on the Ottawa River, including Chenaux and Chats Falls with a combined potential increase in peaking capability of about 240 MW, were not among the 17. We have no reason not to accept Ontario Hydro's evaluation of the merits of these hydraulic developments near Ottawa, but even if they should be developed in the future new transmission facilities would be required, as noted in paragraph 6, above.

8. It is indicative of the seriousness of the supply situation in Ottawa that Ontario Hydro has already installed a centrally controlled system to shed up to about 300 MW of area load to avoid a voltage collapse under a transmission contingency, especially during the period of stop-gap work on critical circuits. Although interruptions of firm supply to Ottawa-area customers would be highly undesirable and should be avoided at all costs, it is encouraging to note that a load-shedding scheme is in place and could be used to prevent voltage collapse in a dire emergency.

9. It may be that the best solution to the Ottawa area problem will involve removing one or more existing transmission lines entirely and replacing them in the same rights-of-way with lines of higher capacity. The Commission is concerned that, if existing circuits are allowed to approach their loading limits, it may be impossible

to take any lines out of service while still maintaining the capacity to supply the load. This reduces planning flexibility, since an entirely new right-of-way would then have to be found for the higher-capacity lines, resulting in greater disruption than would otherwise be necessary.

Interconnections with Neighbouring Utilities

Ontario Hydro is interconnected with Hydro Quebec at several points across their joint boundary, significantly in the Hull area and near Montreal (Beauharnois). These ties permit a total flow from Hydro Quebec to the Ontario Hydro system of about 1,400 MW, but a reverse movement of only about 400 MW. Because such an export to Quebec would result in the preempting of a critical circuit supplying the Ottawa area, Ontario Hydro would only consider making such a sale in the case of a dire emergency on the Hydro Quebec system. Also in eastern Ontario, an interconnection at Cornwall permits 600 MW to be exchanged with the New York Power Pool. With respect to these interconnections, between Ontario and Quebec and Ontario and New York **State**, we find as follows:

1. With respect to the Ontario-Quebec interconnections, we view the present situation with concern and agree with Ontario Hydro that their limited capability is a major factor acting against mutually beneficial interchanges of power and energy. We consider that suitable interconnection between these two large systems with such different basic resources (in energy terms, Ontario Hydro is more than 60 per cent thermal, and Quebec is 99 per cent hydraulic)

would prove mutually beneficial, both from the standpoint of economy of operation and from the standpoint of the increased ability of each system to withstand system emergencies.

2. Ontario Hydro showed that one consequence of the growing load in the Ottawa area is to restrict the capability to export power to the U.S. at the Cornwall border point. Under the reduced criterion, as the Ottawa-area load reaches 1,850 MW, the export capability begins to fall below its 600 MW rating; when the load reaches 2,000 MW, the export capability drops to zero. The Commission recognizes that restrictions in export capability at Cornwall would compound other export limitations at the Windsor and Sarnia interconnections, as noted during the southwestern Ontario hearings. Such limitations would certainly restrict profitable transactions such as the export sales Ontario Hydro has just negotiated with General Public Utilities and Niagara Mohawk, and could ultimately reduce the willingness that exists at present in Ontario Hydro and its southern neighbours to provide mutual assistance in the event of a system emergency.[1]

3. The Commission notes that Ontario Hydro and Hydro Quebec are studying the establishment of a substantial interchange capability in the form of a back-to-back direct current link, rates initially at about 1,000 MW and growing eventually to 2,000 MW. Such a step was also recommended in a recent report by the Inter-Provincial Advisory Council on Energy, which is made up of the provincial Deputy Ministers of Energy. The Commission also recognizes that

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[1] The net revenue by export power sales in 1979 is estimated by Ontario Hydro to be in the neighbourhood of $150 million.

Canada and the United States have recently issued a joint report on electricity exchanges between the two countries. This report states: "The United States and Canada have resolved to explore the potential benefits of increased international electricity transactions and have identified recommendations which can be acted upon by the governments and operating electric utilities." We endorse both of these initiatives.

Recommendations

In its principal submission to the Commission (Exhibit SE2), Ontario Hydro concluded:

> The planning process for the provision of additional facilities must be continued in an orderly way if the in-service dates believed to be necessary are to be met. Confirmation of the need for such facilities is therefore requested from the Royal Commission on Electric Power Planning.

After a careful review of the evidence that came before the Commission in the Eastern Ontario hearings, we accept the existence of a need for additional bulk power facilities and recommend that the planning process proceed to its next phase.

We make the recommendation without qualification despite some reservations we have that Ontario Hydro's forecast of a 5 per cent per annum load growth in the Ottawa area may be high (see the Commission's conclusions in Section V). We do so because we believe that there are already problems in the supply of power to the area which, although minor at present,

will become worse by the time new bulk power (almost certainly transmission) facilities can be installed in the mid 1980s. The rate at which the security of supply to the Ottawa area will deteriorate is in a large measure a function of the rate of load growth. But, on the basis of any realistic assessment of load growth, supply security seems likely to fall below the level prevailing generally in the province.

The Commission has not attempted to evaluate the merits of alternative solutions to the problem of power supply to the Ottawa area since this matter was specifically excluded from its Terms of Reference. We anticipate that such solutions will be considered at the next phase of the approval process, which will probably involve an application by Ontario Hydro under the Environmental Assessment Act, 1975.

The Commission feels strongly on the basis of its full four-year inquiry that it would be in Ontario Hydro's best interests to review the broadest possible range of options before preparing its environmental impact assessments. These options might include:

- connecting the Ottawa area to some of the hydraulic plants on the Ottawa and Madawaska Rivers that are not at present capable of supplying this area
- developing dual purpose (thermal energy and electricity) co-generation systems in the Ottawa area, based on the waste heat potential of the pulp and paper mills and other local industries as well as forest, farm and municipal waste.

For the reasons stated earlier in this summary, as well as in Section X of the Report, the Commission firmly supports the initiatives that are being taken to strengthen the interchange capability between the power systems in Ontario and Quebec and in Ontario and New York. We agree with Ontario Hydro that the ultimate benefits of interconnections generally far exceed those envisaged when they were planned.

As stressed in the Introduction, it is important that this report be read in conjunction with the Commission's Final Report, in which we will address in some detail, for example, the central issue of the decision-making framework as it relates to electric power planning, and the role of the public. We urge, therefore, that major decisions, especially those involving basic planning concepts, some of which have been introduced in this report, be viewed in the light of the conclusions and recommendations of our Final Report. This will be a good beginning.

I - Introduction

During April 1979, the Royal Commission on Electric Power Planning conducted 21 sessions of public hearings in six centres across eastern Ontario - Cornwall, Smiths Falls, Kingston, Prescott, Ottawa, and Arnprior - to consider the need, if any, for additional bulk electric power facilities in the region. The relevant paragraph in Order-in-Council 2065/78, the full text of which is included in Appendix A, reads:

> For the geographic area of Ontario east of Lennox generating station, consider and report to the Minister of Energy on or before June 30, 1979 on load growth in the area up to the end of 1987 and from 1987 to the year 2000, the capability of existing and committed bulk power generation and transmission facilities to supply this load to the area taking into account Government policy with respect to the use of interconnections with neighbouring utilities, and the resulting date at which additional bulk power facilities, if any, will be needed, but excluding consideration of the specific nature of the additional bulk power facilities which may be required and of their locational and environmental aspects;

To put the eastern Ontario hearings into the perspective of the Commission's overall mandate, we have included in Appendix B the Commission's original Terms of Reference as well as the amendments that relate specifically to the present inquiry. Order-in-Council 2065/78 also required the Commission to report on the need for additional bulk power facilities in southwestern Ontario; that report was presented to the Minister of Energy on June 8, 1979.

This report presents our findings and recommendations concerning the need, if any, for additional bulk power facilities in eastern Ontario.

It is important to note that, prior to the commencement of the regional hearings in March 1979 in southwestern Ontario, the Commission held certain reservations concerning the adequacy of the information and data base that was provided by Ontario Hydro, and at various times considered postponing the hearings - see the Chairman's opening statement, in Cornwall on April 19, 1979, and Mr. Bruce Campbell's response, in Appendix C. The Commission's questioning of the adequacy of information related specifically to the data base upon which the forecast loads for the eastern Ontario region are predicated; this topic is considered in Section V.

Although an earlier reporting date (on or before June 30, 1979)[1] is required for the present report than for the Commission's Final Report (on or before October 31, 1979), it should be read in conjunction with the Final Report. Indeed, it cannot be over-emphasized that the concepts underpinning electric power planning, consideration of which is our major task, relate to Ontario's electric power system as a whole. The utilization and behaviour, from instant to instant, of major components located in a particular region are inextricably linked with the loads being supplied in the total system. On the other hand, it is meaningful to consider the electric power load in a region, area, or municipality and to attempt to forecast the growth or decline of that load. If sufficient weight can be attached to the forecast loads, the future dates by which additional bulk power facilities will be needed to meet those loads with adequate levels of reliability can be assessed. The hearings

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[1] The reporting date was subsequently extended to July 16, 1979.

we completed in April have added appreciably to our knowledge and understanding of the basic planning concepts that are relevant to the whole power system, and will help materially in the preparation of our Final Report.

A schedule of the public hearings held in eastern Ontario, together with a list of participating organizations, institutions, public interest groups, and individuals, is given in Appendix D. Each participant in his or her own way helped us to understand better the complex issues that were submitted to us. We are grateful for all these contributions. We acknowledge also the significant contributions of Ontario Hydro (counsel Bruce Campbell and his various panels of experts); and, of course, those of our consultants, Ken Slater and Keith Kidd, our field workers, David Creighton and Don Munro, and our dedicated staff.

II - Historical Notes*

Before the Hydro-Electric Power Commission of Ontario (HEPC) was established in 1906, many small electric power companies, some privately owned, some municipally owned, some using steam power, some using hydraulic power, were extant. Almost all of these systems were taken over by Ontario Hydro during the ensuing decades.

The move towards public electric power developed in municipalities of the area west of Toronto, to which the newly created Hydro-Electric Power Commission of Ontario had begun to deliver power from Niagara. But public power was destined for the whole province, and in 1907 one of the first acts of the HEPC was to assist Ottawa by contracting with the Ottawa and Hull Power and Manufacturing Company to purchase hydro-electric power for resale to the city (which, incidentally, had recently purchased a distribution system). The original contract was for 1.1 MW; this was increased in stages to 15 MW.

In the early years, Ontario Hydro's main role in eastern Ontario was to purchase power from private companies, deliver it over 115 kV lines (now relatively low-voltage), and resell it to municipal utilities with their own distribution systems. In this way, the St. Lawrence System, which extended from Morrisburg to Prescott and north to Winchester, was established in 1913 (Brockville was added in 1915), and the Rideau System, including Chesterville, Almonte, Carleton Place, Kemptville,

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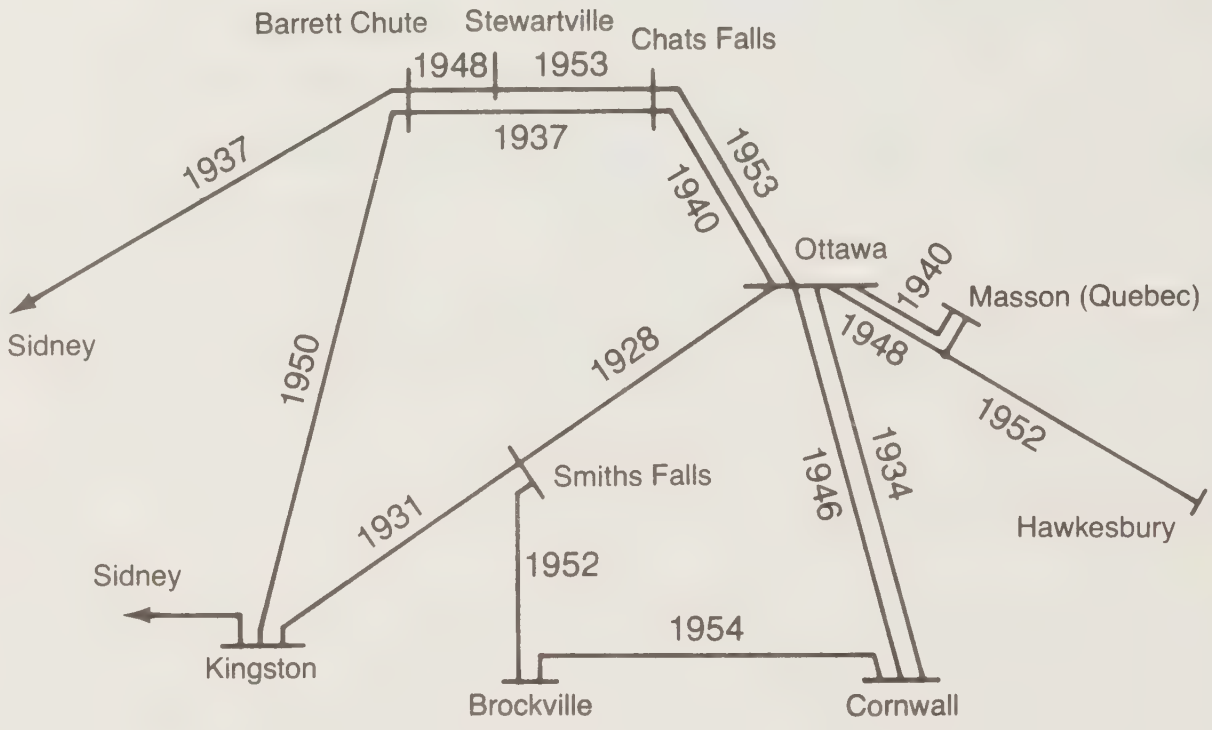
*This section is based on material kindly supplied by J. P. Dobson of Ontario Hydro.

Eastern Ontario – 115 kV Network

(date is year of first service)



Source: Ontario Hydro

FIGURE 2.1

Lanark, Merrickville, Perth, and Smiths Falls, in 1918. Further system expansion came through the purchase of the M. J. O'Brien System in the Madawaska area (in 1929) and other operating systems. Also in 1929, the Eastern Ontario System was formed by combining the St. Lawrence, Ottawa, and Rideau systems with the central Ontario systems. The only generating station built by Ontario Hydro in the early years to supply eastern Ontario was the High Falls station in the Rideau System, built in 1920.

By 1928, difficulties were being encountered in obtaining sufficient power for the isolated areas from small generating stations, and it was decided to make a major purchase from the Gatineau Power Company in Quebec. This power, which reached 45 MW by 1938, was delivered to Ottawa at 115 kV and was being transmitted from there to Smiths Falls and Kingston by 1928, and to Cornwall by 1934, thereby integrating systems that had previously been separate. (Fig. 2.1). The system was further augmented by a connection (through a frequency changer) from the Chats Falls generating station to Ottawa in 1940, and by a line from the High Falls generating station of the MacLaren-Quebec Power Company to Ottawa. Additional hydraulic generating stations were built by Ontario Hydro on the Madawaska River, at Barrett Chute in 1942 and at Stewartville in 1948, together with transmission lines connecting these stations with the 115 kV grid. The main 115 kV system reached its maximum extent by 1954. (Fig. 2.1). A number of short sections of line have been added since, mainly to supply new transformer stations.

Although most of the eastern Ontario loads were supplied at 60 Hz

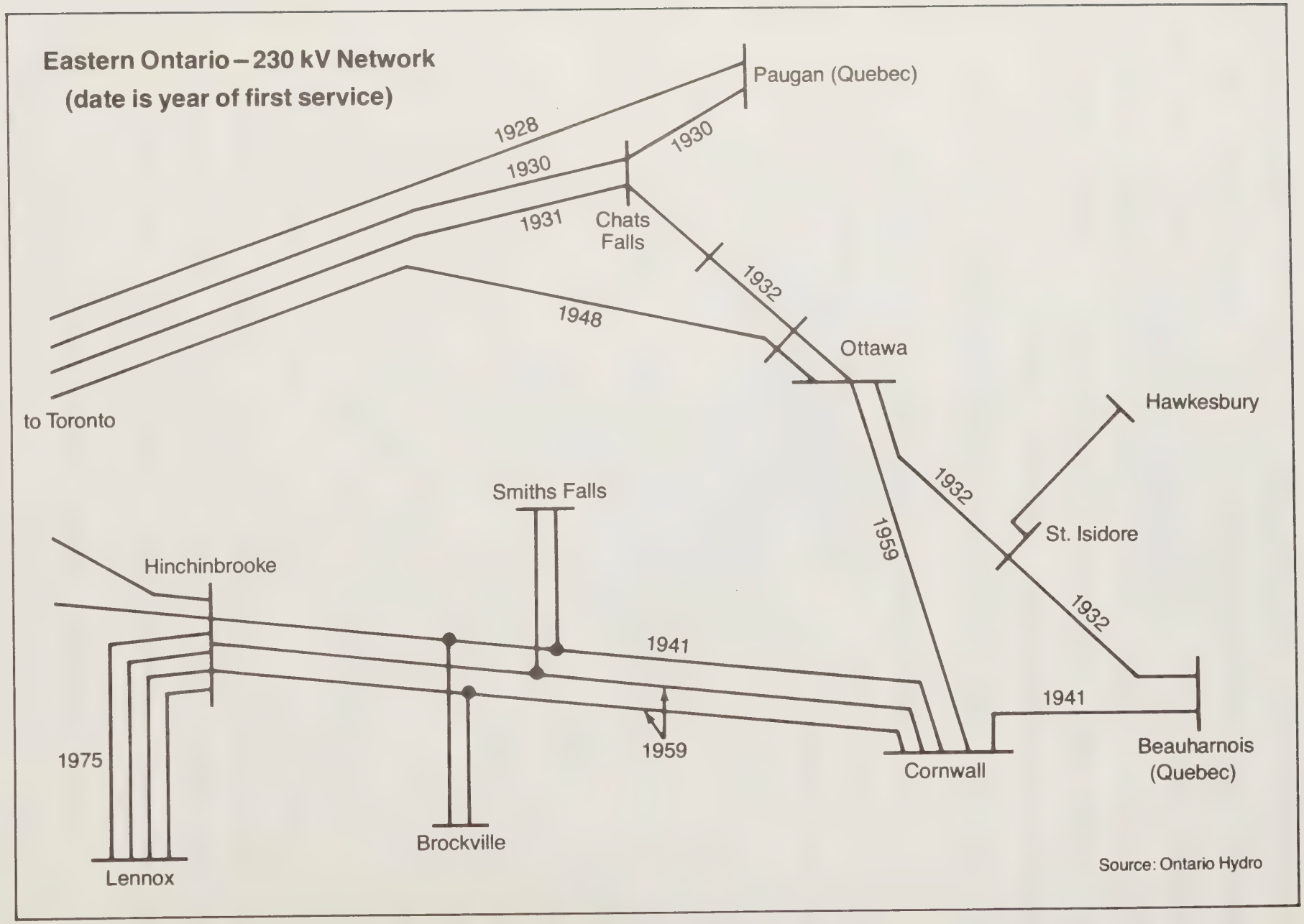

Eastern Ontario – 230 kV Network
(date is year of first service)
Paugan (Quebec)
1928
1930
1930
1931
Chats Falls
1932
1948
Ottawa
to Toronto
Hawkesbury
1932
St. Isidore
1959
1932
Smiths Falls
Hinchinbrooke
1941
1941
1959
1975
Cornwall
Beauharnois (Quebec)
Brockville
Lennox
Source: Ontario Hydro

FIGURE 2.2

from the beginning, a major 25 Hz programme proceeded in parallel. It involved constructing a station to generate 25 Hz power at Chats Falls in co-operation with Quebec and negotiating contracts to purchase 25 Hz power from the Gatineau and MacLaren Power Companies and the Beauharnois Light Heat and Power Company, all in Quebec. This power was transmitted to Toronto on 230 kV lines, the first of which was placed in service in 1928. It was one of the first systems in the world to operate at 230 kV. During the period 1948-59, a province-wide frequency standardization programme was undertaken, and, today, the whole system except for some heavy industry in the Niagara and Hamilton area, in common with all North American utilities, is based on a frequency of 60 Hz.

The 115 kV transmission system, connecting regional loads to the stations at Barrett Chute, Stewartville, and Chats Falls and to a number of smaller generating stations, and handling major purchases from the Gatineau and MacLaren companies, was heavily strained by the mid 1950s. However, the 25 Hz generating stations at Chats Falls and in Quebec were being converted at this time to 60 Hz operaiton, and in 1958 the R.H. Saunders station at Cornwall came into service. The 723 MW capacity of the Saunders station is Ontario Hydro's share of a station jointly developed with the Power Authority of the State of New York. The installation of 230 kV switching and 230/115 kV transformer equipment at Cornwall (1956), Kingston (1959), and Ottawa (1961) made it possible to reinforce the 115 kV network at three major locations. In 1976 a hydroelectric plant with a peak capacity of 70 MW was built at Arnprior and connected to the 230 kV network. The present 230 kV network is shown in Fig. 2.2.

No major 230 kV lines have been placed in service in eastern Ontario since 1959, except for a short section at Lennox. All of the firm power contracts with Quebec suppliers, which at their peak had totalled about 1,200 MW, had expired by 1977.

Extensions to the hydraulic stations at Barrett Chute and Stewartville in 1968-9 increased the total dependable peak capacity of those stations to 338 MW. In 1977, Ontario Hydro commissioned its first thermal-electric generating station in eastern Ontario, the four 500 MW oil-fired units of the Lennox station (west of Kingston). Lennox is used in peaking conditions.

The landmark events in the development of the bulk power system in eastern Ontario are summarized in Appendix E.

III - Statement of the Problem

The Terms of Reference relating specifically to the eastern Ontario regional hearings (Appendix A) may be conveniently interpreted and expressed as three interrelated problems:

1. The estimating of electrical load growth in the specified region up to the end of 1987 and from 1987 to the year 2000. Estimates of the growth of load in the Ottawa area - the supplying of which, Ontario Hydro argues, "precipitates the earliest requirement for major new facilities" - were included as Figure 10 in Ontario Hydro's submission, "Bulk Power Facilities - Eastern Ontario" (Exhibit SE2). Ontario Hydro estimated that the Ottawa area load constitutes some 60% of the load in the Eastern Ontario Region. The problem facing the Commission in this regard is essentially one of assessing the acceptability of the utility's load-forecasting methodology and the adequacy of the information on which the load forecast is based.

2. If, in the opinion of the Commission, the load growth estimates for eastern Ontario (or for the critical load area around Ottawa) provide an acceptable basis for planning additions to the power system, the second problem is to assess the ability of existing facilities in the area to supply the load that is projected up to 1987 and between 1987 and the year 2000, taking into account, as Order-in-Council 2065/78 puts it, "Government policy with respect to the use of interconnections with neighbouring utilities". (That policy is spelled

out in Appendix F.) As in the southwestern Ontario report, the Commission assumes that the "stop-gap" measures proposed by Ontario Hydro to increase the current carrying ability of certain critical components of the eastern Ontario bulk power system will be completed on schedule by the early 1980s. These are detailed in Section IX.

3. On the basis of the answers to (1) and (2), defined above, we are required to determine the resulting date at which additional bulk power facilities, if any, will be needed.

The Commission's interpretation of its Terms of Reference were challenged in Prescott on April 19, 1979, by representatives of the Association of Concerned Ratepayers of Prescott (SE36) and by People Against Nuclear Development Anywhere (PANDA) (SE3]). PANDA stated that its concern as a citizens' group stemmed from the efforts of Ontario Hydro to locate a site for a generation complex in the Prescott area (Tr286:43,254ff). PANDA noted that, notwithstanding the reference to "bulk power generation and transmission facilities" in the Order-in-Council, the emphasis in the eastern Ontario hearings had been exclusively on transmission requirements.[1] But the Commission observes that, in Exhibit SE2 (pages 1-3), Ontario Hydro states that "the most urgent requirement is to supply the growing load in eastern Ontario ... Another requirement is to reinforce the interconnections with New York State and Quebec ... The third requirement for new transmission is to incorporate future generating stations ... The first of the three requirements discussed above ... is the most urgent...."

Thus, for the pragmatic reason that Ontario Hydro has not identified additional generation capacity in the Prescott area as an urgent priority

affecting the reliability of power supply in eastern Ontario, together with the fact that the Commission is specifically enjoined by the wording of the Order-in-Council from considering solutions to the problems identified, we will not consider further in this report the matters raised by the Association of Concerned Ratepayers and PANDA. We are, of course, aware of the intensity of the feelings that have been aroused by Ontario Hydro's site selection activities in the Prescott area in recent months. But we are also convinced that, prior to the construction of any new generating facilities in the Prescott area (and probably prior to the acquisition of any potential site), the citizens of the area will have an opportunity to be heard before the Environmental Assessment Board in the "full and open hearings" sought by PANDA in its submission to this Commission.

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[1] Counsel for Ontario Hydro pointed out that the Order-in-Council asks for the date at which additional bulk power facilities, if any, will be needed, and this date "is controlled by the capability of the transmission to serve load in the Ottawa area...[not] a lack of generation" (T286:43275). Later, in Ottawa, Mr. Campbell agreed with the Commission examiner, Ken Slater, that Ontario Hydro's case is essentially that the sum of generation in the Ottawa area plus transmission capability into the area will become insufficient to supply the load with acceptable reliability (T289:44,238).

IV - The Submissions

In this section we present, in the form of direct quotes, the major issues raised in submissions presented to the Commission by the public during the eastern Ontario hearings. These submissions, together with the material submitted by Ontario Hydro, provided the basis for the hearings. Ontario Hydro's principal documentation consisted of their report, "Bulk Power Facilities Eastern Ontario", December 1978 (entered as Exhibit SE2), and the associated "Supplementary Information" provided in March 1979 (Exhibit SE3) as further supplemented by SE12 and SE63, which relate to transmission planning matters, and SE23 on the 1979 Load Forecast.

Of the public submissions presented, 13 came from industry, 12 from municipalities, 10 from public interest groups, nine from individuals, seven from public utility commissions (PUCs), two from farm organizations, and five from other institutions such as hospitals and universities. Appendix D contains a complete list of these submissions.

In most of the communities visited, local public utility representatives and/or Ontario Hydro regional or operating area managers contributed their particular perspectives to the load-forecasting function of Ontario Hydro. Without exception these representations supported Ontario Hydro's contention that additional bulk power facilities are needed in eastern Ontario. In this they were joined by representatives of industries, federal and provincial governments, municipalities, chambers of commerce, hospitals, and universities. In contrast, individuals and spokespersons for public

interest groups were generally skeptical of or opposed to Ontario Hydro's plans. The farm groups, while arguing that Ontario Hydro's load forecasts were probably too high, were strongly in favour of maintaining reliability of supply and upgrading the bulk power transmission system as required to ensure this.

Although the subjects addressed in the public submissions were broadly the same as in the southwestern Ontario hearings, namely, load-forecasting methodology, load growth in the area, energy conservation and renewable sources of energy, transmission planning and system reliability - several of the issues raised were peculiar to eastern Ontario. These included the propriety of locating a generating station in the Prescott area, the implications of the move of federal civil servants from Ottawa to Hull, and the desirability of power exchanges with Hydro Quebec.

As in southwestern Ontario, the load-forecasting process was of major concern. The following are excerpts from submissions that are representative of those that endorsed Ontario Hydro's load-forecasting process and, in particular, Ontario Hydro's emphasis on the inputs of the PUCs.

> ... when we have to determine what our works programs are going to be ... the first thing we do is we look into the past. We try to see what has been happening ... this has proved in the past quite a reliable guide as to what is going to happen at least in the near future. And with reasonable accuracy ... a one or two year plan with a rough idea of what might be happening for a few years further ahead is adequate for you to proceed. (Tr289:43,670)
>
> Arthur J. Bowker,
> Commissioner,
> Gloucester Hydro

I think you will find that our forecasts up to and including 1976 are pretty good... We under-estimated consistently by about 2 per cent. For 1977 and 1978, of course, we completely fell off the wagon like a lot of other people ... but I think you will see that we reacted quite quickly in that the forecasts for the years beyond 1978 indicate that we scaled down our anticipated load by a very considerable amount. (T291:43784)

Lloyd Askwith,
General Manager,
Ottawa Hydro Electric
Commission

... our figures are almost on the button for those two years [1978 and 1979] and I think that this is due to the fact that we are closer to the local scene and therefore in a good position to judge. (T282:42860)

Dr. R. H. Hay,
Commissioner,
Kingston Public Utilities
Commission

We have no reason to believe that forecasts by industry on the future general level of economic activity are any more credible than those provided by other institutions but the credibility of a forecast does tend to increase when each company is confined to project its own future activities particularly in the near term. When these projections are then considered as a whole, together with a healthy measure of scepticism, to provide a general forecast, then we would be inclined to accept that forecast as a reasonable base for planning future facilities. (SE48:3)

A. Munroe,
Executive Director,
Association of Major
Power Consumers in
Ontario (AMPCO)

Criticism of Ontario Hydro's load forecasting practices ranged from the expression of specific methodological concerns to calls for an entirely new approach to the exercise.

... if I have this amount of difficulty out of trying to discern the basis of the forecasts, the reliability of the forecasts, much less the accuracy ... what about other people who do not have the time or expertise to ask the kind of questions that I'm asking? (T282:42805)

Prof. Gerald Hodge,
Director, School of
Urban and Regional
Planning,
Queen's University

Ontario Hydro's submission makes no allowance for over-all saturation and gives only token weight to conservation. Since these factors are having a profound effect on current demand levels and will have monumental effects in the future, any forecast which does not take them fully into account is worse than useless. (SE36:17)

Association of Concerned
Ratepayers,
Prescott, Ontario

One of the things I think is inevitable about current forecasting questions is that a forecast by Ontario Hydro and any hydro utility is inevitably going to be on the ...high side ... I cannot see any way of eliminating that unless you can go to an over-all energy ... discussion before getting into the actual load forecasting process. (T293:44145)

C. W. Woodley,
National and Provincial
Parks Association

I don't think it is simply a question of asking Ontario Hydro to do an end-use electric forecast or an end-use energy forecast. I think it is important to involve citizens of an area in helping decide what their energy uses are going to be and how best for that area they can be met. (T289:43585)

Evelyn Gigantes,
M.P.P.,
Carleton East

> We recommend that a comprehensive energy plan is needed for Ontario for accurate forecast predictions. Our suggestion would be the establishment of an Energy Planning Authority of which hdyro electric power is only one of the components. Other energy sources would also be represented. (SE37:3)
>
> Dundas County Federation of Agriculture

A number of opinions were expressed on the role of Ontario Hydro's load forecaster:

> I believe that it is the job of the forecaster to produce a responsible forecast, using all the available information. (T280:42693)
>
> Paul Neelands,
> Thyme & Sage Machinery Ltd.
> Perth, Ontario

> A dispassionate, impartial forecaster, in my book, will do his best to try to predict what people are likely to do and what they're likely to want and not what he thinks they should want ... (T282:42851)
>
> Dr. R. H. Hay,
> Commissioner,
> Kingston Public Utilities Commission

> I think the responsibility for identifying the goals lies with governments. A government forecaster for Hydro cannot be called upon to predict government policy. He should be told what the goals are and those goals, I believe, should be identified on an area basis, as, for example, in Eastern Ontario. (T289:43571)
>
> Evelyn Gigantes,
> MPP, Carleton East

Most participants offered their own opinions on the rate of growth of electrical load, on behalf of their industries or for eastern Ontario

as a whole. A number argued that development was important for an economically depressed area of the province.

Industrial

There are certain specific factors that influence load growth in Vankleek Hill area, and number one is industrial growth within the Town of Hawkesbury as projected by the Industrial Commission and anticipated government assistance in attracting new industry, and naturally, there will be attendant benefits to the rural area by the creation of new jobs. (T276:42354)

David Venutti,
Manager, Vankleek Hill Area,
Ontario Hydro

Since they commenced operating in 1971, the IVACO facilities in L'Orignal have experienced substantial and rapid rate of growth. This growth is reflected in the electrical power demand growth over that period ... of 8.1% per year average. This annual growth rate is considerably higher than most, if not all, predicted growth rates for eastern Ontario during that period, and is a conservative estimate based on present growth plans of the company. (SE52:7)

IVACO Rolling Mills &
Eastern Steel Casting
L'Orignal, Ontario

I am prepared to predict that at least over the next 15 years and possibly longer we will not see much [industrial] growth, but we will probably not see any decline; we will probably see more firms added, but we will also see more efficiency amongst the industrial firms which presently exist: and so my educated guess is that the number of people employed in manufacturing in Eastern Ontario will probably remain rather stable over the medium to long term. At the same time ... there will be a commensurate increase in the value of output in industry.... (T282:42824)

Prof. G. Hodge,
Queen's University

This region in the past has been designated as a slow growth area. However, we are progressively seeking new development opportunities and looking at diversification of our economic base. Both levels of government are recognizing the emergence of our communities and providing incentives to attract and encourage new industries and existing industries to expand. Senior governments are now looking to decentralization, this in itself should have favourable effects on communities like Smiths Falls. (SE17:2-3)

Smiths Falls Chamber
of Commerce and Industrial
Development Commission

Agricultural

Eastern Ontario has 12% of the population of the province but has 15% of the farms. There are well over one million acres of prime agricultural land in eastern Ontario. The 12 Eastern Counties, of which Dundas County is quite representative, produce 18% of Ontario's silage corn, 25% of the hay, and 27% of the dairy products. Dairying accounts for 66% of the farms, other livestock account for 26%, with cash-crop grain farming also gaining in prominence. By whatever statistics chosen, agriculture emerges as an important sector of the economy in eastern Ontario. (SE37:1)

Dundas County Federation
of Agriculture

When we threw around the percentage we sort of agreed that 4% or something like that would certainly be a reasonable expectation for [farm load growth]. (T286:43341)

K. Matthie,
Grenville County Federation
of Agriculture

Right now the rural countryside is undergoing rapid change, consolidation of farms, a lot of people are leaving, older people are leaving, younger people cannot get in because almost every type of farming situation you're getting into now you require quotas of some kind or another ... the quotas are difficult to get, they're fixed, they're not transferable in many cases. (T278:42533-4)

L. D. Cotton,
County Planner,
United Counties of Stormont,
Dundas, and Glengarry

[As a result of] consolidation of farms, ... the net use of the energy is going to be centred in one spot. It will never equal the total usage of the two [farms which were consolidated]. We are going to increase our energy use somewhat - it will never be the same as the two before. (T287:43372)

J. Dalrymple,
Dundas County Federation
of Agriculture

In conclusion with the increase in agricultural productivity in Dundas County and eastern Ontario, and the corresponding decrease in the number of farmers, the energy usage in agriculture is unlikely to increase to the levels suggested by Ontario Hydro's projections ... The energy available in [Ontario Hydro's] low forecast would mean that farm energy usage could double in the next twenty-five years. Our overview does not indicate this doubling, but a somewhat lesser increase. (SE37:3)

Dundas County Federation
of Agriculture

Residential

I would think that the major townships surrounding the City of Cornwall will grow, albeit a little slower than they did between '71 and '76, the reason being that the baby boom is pretty well over ... I would see [the Lancaster-Alexandria] area growing more rapidly in the future, particularly after the [Quebec] referendum....(T278:42533)

L. D. Cotton,
County Planner,
Counties of Stormont,
Dundas, and Glengarry

It is clear that there will be a need for increased electrical power supply early in the mid-eighties even if we experience a three-per cent load growth which is more than justified based on trends of the past several years. But, it could, in fact, be somewhat low if the anticipated increase in housing production continues.

John Russell,
Housing & Urban Development
Association of Canada (HUDAC),
Ottawa

Several submissions were addressed to the likely effect of federal initiatives respecting the decentralization or reduction of the civil service on the growth of the Ottawa -Carleton region, the heart of Ontario Hydro's critical load area in eastern Ontario. Messrs. Bunting and Turcot of Queen's University initiated the debate by hypothesizing in Exhibit SE27 a short-term loss in Ottawa's population of 67,000 as a result of these initiatives.

> The Federal Government decentralization programme and relocations to Hull, Quebec, are decelerating. As a consequence of this policy, our load reduction is estimated at about 5 MW. Several facts are worthy of note in respect to this policy.
>
> First, although the work place of some 15,000 federal employees is now just within the Quebec border across the Ottawa River, most of these employees continue to reside in Ontario. Further, given the current political situation in Quebec, it may be that the vast majority of these people will continue to live and to shop in the Ottawa area.
>
> Secondly, almost all of these federal employees were accommodated in rented buildings in Ottawa. As a consequence, it is estimated that there are now some 4,000,000 square feet of vacant office space. Already, a couple of these buildings have fallen back to the mortgagee and it is apparent that rents will have to be reduced to attract new tenants. This coupled with an active advertising campaign by the larger holders will eventually attract new companies to the Ottawa area and the new employees will have a propensity to live in Ontario. Consequently, now only do we expect to recover the temporary load reduction of 5 MW but also the residential demand of these new employees will be added to the Ottawa area peak. (SE50:10)
>
> Ottawa Hydro

The Ottawa-Carleton Region has been, and continues to be, one of the fastest-growing population centres in all of Canada, but growth has not approached the pace predicted by the draft official plan of 1972. What is more significant, a large number of reflective residents of this area were aware, in 1972, that the assumptions of growth which were the basis for the draft official plan were neither reasonable nor desirable.

I think the same can be said of Ontario Hydro's assumptions for growth of demand for electric energy in this area. The assumptions are neither reasonable nor desirable. The plans for expansion of electric generation and transmission which follow from those assumptions are already demonstrably too grandiose and expensive. (SE41:3)

E. Gigantes,
MPP,
Carleton-East

Even the most conservative of these [population] projections may in fact now be too high. During the past two years the Federal Public Service, as the primary employment generator in the region, has in fact reduced slightly the numbers of employees in the National Capital Area....More important, in terms of population forecasting, is that both major political parties are committed to a further reduction in the size of the Federal Public Service. (SE68:2)

North Lanark Energy
Conservation Centre
Almonte, Ontario

> I know there are those who are questioning the need for additional growth in the area but I think if you were living in the Ottawa-Carleton region, and saw the results as we have recently of the federal government's activity, decentralization, etc. you would realize we have had all our eggs in one basket much too long and if we are going to broaden the base of our economy in this area there is bound to be growth. We have already had it [in the high] technology field particularly. I see no reason to think that the Ottawa area is going to grow faster or less quickly than a lot of other areas in the country. (T290:43698)
>
> S. Ballantyne,
> Commercial and Industrial
> Development Corporation
> of Ottawa-Carleton

Without exception participants favoured more attention being given to energy conservation, although the PUC spokesman pointed out that unless accompanied by peak load controls the result could be declining load factors.

> ... we do believe that controls must be imposed on all new construction to ensure the maximum efficient use of electric power. (SE17:3)
>
> Smiths Falls Chamber of
> Commerce and Industrial
> Development Commission

> The Ontario government should upgrade the provincial building code to ensure that all new construction ... is as energy efficient as practically possible. This goes beyond insulation levels and includes such things as window area and orientation ... surface area: volume ratios and so on. (SE36:14)
>
> Association of Concerned
> Ratepayers,
> Prescott, Ontario

> Conservation to date has resulted, in my view, in some conservation of energy, but not a corresponding decrease in demand, and it is the demand which governs and determines the facilities that must be put in place. (T282:42847)
>
> Dr. R.H. Hay,
> Commissioner,
> Kingston Public Utilities
> Commission

> Ontario Hydro seems to have underestimated the role of conservation within the forecast period. (SE27:11)
>
> P.M. Bunting and M.C. Turcot,
> Queen's University

(Bunting and Turcot proposed a series of "peak management" techniques, including the urging of restraint at electrical "rush hours", time-of-use rates, and more widespread control of appliance loads.)

> The reason that our system load has remained relatively flat since 1976 is to be found largely in federal government programmes and I will mention two in particular. The one is the programme of decentralization ... The second important [one is the Government's] comprehensive and ... very, very effective conservation programme, [the impact of which started] to be felt about three years ago.
>
> L. Askwith, Manager,
> Ottawa Hydro

> If only for the sake of avoiding future cancellations and postponements of committed generating capacity, load forecasters would be wise to adopt as dynamic a view as possible of the potential of energy conservation. (T292:43972)
>
> Michael Bein,
> Ottawa, Ontario

There was a lively debate on the question of the relative rates of capture of the space and water heating markets by natural gas and electricity.

... in this eastern region of the Consumers' system it is only in recent years where we have been fortunate to make inroads in the new housing market and, in fact, major inroads into the existing housing market. The gas company ... has been in existence in the City of Ottawa since 1884. When natural gas arrived here at approximately 1956 there were 7,000 customers in existence using gas at that time. By 1973 that figure had only increased to 17,000 ... it is now 39,000. Our rate of growth is approximately 15% ... per year which is in excess of the growth in the areas we serve, so that we are capturing from 500 to 1,500 conversions of residential homes from other fuels each year over the past five years. (T293:44105)

... we anticipate in the year 1979-80 to add 2,500 homes from new construction and to convert 1,445, all basically from oil and none from electricity. We anticipate an increase in load of 3,170 water-heaters, the majority of which will be from new construction. We anticipate 200 ranges.... A similar calculation can take place for dryers. (From a letter to RCEPP dated May 15, 1979)

R.H. Townsend,
Consumers' Gas Co.,
Ottawa

It is our experience ... when the home heating is converted we are converting approximately 75% of water heating immediately from electricity and we get a larger percentage of it as the tanks wear out. (T293:44118)

R.H. Townsend,
Consumers' Gas Co.,
Ottawa

The percentage of new construction installing electric heat amounted to a high of 77.2% in 1977 and 68.3% in 1978. The electric heat customers rose from 12% in 1973 to 30.8% in 1978 of the total residential class customer. Electric heating is predominantly baseboard with the exception of most mobiles, which utilize a central furnace. (SE:3)

D. Venutti, Manager
Vankleek Hill Area,
Ontario Hydro

All industrial and institutional representatives making submissions indicated that they were taking energy conservation seriously, the motivating factor being strongly economic.

Ottawa University has reduced their energy use 15% for the last two current fiscal years. That is electricity and natural gas combined and they can claim, I believe, that that is in the most improved player category of the 14 Ontario institutions. (T292:43924).

E. Butterworth,
Energy Manager,
University of Ottawa

I think price is probably the first step ... and it is probably the most important for us. But then communication is not very far behind in motivating people to carry out energy conservation. (T291:43768)

J. Holowka,
Plant Engineer,
R.L. Crain Ltd.
Ottawa, Ontario

We expect that the [energy management] project will have paid for itself before it is completed, and that time is four to five years, depending on how far we go with this system. By that time, when the five years is up, it will have produced more savings than [it cost]. (T285:43082)

G. MacCahill,
Dept. of Physical Plant,
Queen's University

Some of the smaller manufacturers I don't think have done very much to conserve electricity. It has been mostly the larger companies who have the expertise available to do this. (T290:43729)

A. Munroe,
Executive Director,
AMPCO

Since 1974 there have been determined efforts at the company to reduce all forms of energy used. On the electrical side attempts have been made to reduce both the demand and consumption with the result that the respective figures which were of the order of 1,360 kW and 400,000 kWh/month are now 832 kW and 280,000 kWh/month. (SE66:2)

> In Canada we are not really seriously tackling energy conservation.... Even in our own homes, only lip service is paid to this question. I believe we should make a real, a serious attempt at energy conservation and the result would not be the expansion ... Ontario Hydro is talking about. (T295:44275)
>
> C.G. Hill,
> Manager of Engineering
> Huyck Canada Ltd.
> Arnprior, Ontario

Several submissions expressed support for alternative or renewable energy developments, some pointing out the opportunities offered by eastern Ontario.

> Ontario Hydro should greatly expand its industrial co-generation program enabling industries to generate all or some of their electrical requirements from waste materials. (SE36:14)
>
> Association of Concerned
> Ratepayers,
> Prescott

> Queen's University will be evaluating the cost-benefit of approximately 1,000 kW of co-generation at the Central Heating Plant. If this is feasible, if we have some assurance that the demand charges will remain at about equal to the energy cost and if co-operation with the utilities is possible, we can reduce our demand on the hydro system by a further 15%. (SE25:2)
>
> G. MacCahill,
> Dept. of Physical Plant,
> Queen's University

> In addition to the continuing program of conservation, Ontario Hydro should, we believe, continue the study of every feasible alternative mode of power generation. Included are development, or re-development, of existing small hydraulic sites, burning of processed waste as fuel for generating stations, co-generation, wind and solar energy. We recognize that many of these studies are long-term in nature and most can contribute only in a modest way to the short-term energy needs of Ontario. (SE50:5)
>
> Ottawa Hydro

Representatives of the Ontario Ministry of Natural Resources made submissions in Cornwall and Smiths Falls. Both predicted a continuing market in rural areas for wood for space heating.

> ... rural areas traditionally use wood anyway; they always have and I guess always will because it's handy and it's a cheap source....I don't think it's feasible in the urban situation. (T278:42558)
>
> J. Higham,
> Ministry of Natural Resources
> Cornwall

They were also questioned on the uses of waste wood as fuel in industry.

> I questioned Domtar as to whether they were considering ever converting to using waste wood as a source of fuel ... They can't really see going to generating their own energy through waste material, because as soon as they start trying to get the amount or volume of wood from the area that they are already getting pulp wood from, they are going to be competing for their own product ... I see it feasible in small things like the Iroquois plant pallet mill but I don't see it on a large scale like the Domtar Mill or a 100 MW [electric power] plant. (T278:42566)
>
> J. Higham,
> Ministry of Natural Resources
> Cornwall

The use of poplar plantations to provide fuel for generating stations was mentioned; however, the Ministry is at this stage only engaged in growing poplar for use as pulp, and even this programme is only at the developmental stage.

Another major concern was that of the reliability of the electric power supply and the related question of the cost of interruptions. It was stressed by almost all those presenting submissions.

Mr. Slater: How does your process react to power interruptions?...

Mr. Rumple: It's a chemical plant. There's always the danger of chlorine being released and this is environmentally unacceptable. It means that you have to spend a fair amount of additional money to prevent this ... and even then you cannot be assured.... We can't feel 100% safe. (T278:42510)

E. Rumple, Works Engineer,
Canadian Industries Ltd.,
Cornwall Works

It [reliability of supply] is critical because we have to have continuity of supply. There are really very few farms ... equipped with an emergency generator. (T287:43389)

R. Dulmage,
Dundas County Federation
of Agriculture

... the consequences of failure to plan and obtain approvals for new facilities are awesome indeed. The disruptions, inconvenience and hardship arising from deficiencies in our electrical supply system would simply not be tolerated by our systems and I can attest to that because I speak from long experience and I know the attitude of the public to power failures. And yet with the lead times we are now faced with, seven years for transmission facilities, maybe 14 for generation facilities, little could be done to retrieve a situation should a mistake be made now. The responsibility for your decision is very heavy but in the end the consequences are likely to fall on the shoulder of the utility management. (T291:43794)

L. Askwith, Manager
Ottawa Hydro

With a good supply, we can guarantee any industry that it has all to gain by settling in our town. This would help alleviate the fact that we have the highest unemployment rate in the province of Ontario. (SE57:4)

Hydro Hawkesbury

There are a number of research projects underway at all times and grants for those are considerable and the research required is typically on-going for a year or better to prepare the data required. It is often told to us by academics that an interruption of a specific research test invalidates the entire results. (T292:43921)

E. Butterworth,
University of Ottawa

Because the hospital has up until now been able to rely upon the availability of power from external sources *internal emergency power generation will meet only one-third of our needs*. This allows the hospital to operate life support systems, patient monitoring equipment and meet other minimal operating requirements for short durations. This means that much of the other diagnostic and treatment equipment and most of the support service facilities would have to be shut down. Therefore, any protracted power outages could have very serious effects upon the ability of the hospital to continue to provide a safe level of patient care ... (SE59:2)

Ottawa Civic Hospital

It [reliable supply of power] is always a subject in negotiations. We find that we have been able to respond positively up to the present time, that our supply has been adequate ....What we are looking for from the point of view of planning is that that state of affairs continues to exist and that we can, in fact, talk about having adequate and good quality and steady power available, and not subject to brown-outs or shutdowns. (T296:44335)

R. Thomson
Industrial Commissioner
Town of Renfrew

The major concern is primarily that the frequency of *non-scheduled* (no prior notification) interruptions will increase dramatically as the transmission system is pushed beyond its rated capacity, causing a significant reduction in its reliability. Of secondary concern is the probability that the frequency of *scheduled* curtailments will also rise. The latter will certainly prove to be of serious consequence in terms of plant productivity; the former will likely cause damage to expensive equipment which

would lead to costly repairs, extended loss of production, and perhaps even layoffs of portions of the work force while equipment is shut down. In summary, therefore, the security of supply is the critical condition. (SE52:13)

IVACO
L'Orignal, Ontario

With respect to the value we place on reliability of service, an electric power interruption of less than 1 minute duration typically results in half a day's lost ammonia production. We are net buyers of ammonia and therefore cannot make up lost production. Assuming for the purpose of this calculation no other cost penalties (which is seldom the case), such an interruption results in a minimum penalty of $24,000 per occurrence. Longer downtimes will engender increasing cost penalties which become exceedingly difficult to quantify. (SE33:3)

Genstar Chemical Ltd.
Brockville, Ontario

Kanata strongly recommends that Ontario Hydro proceed immediately with the planning study for additional transmission capacity in Eastern Ontario to ensure that continued development in this area is not choked off due to lack of adequate transmission facilities. (SE69:1)

M. Wilkinson, Mayor,
City of Kanata

The development industry is important to the Ottawa area as it is to any other urban area. It must be possible for the industry to continue to develop housing for future population growth. If there are rumours that there could be a lack of power and, in the long term, black-outs, this could severely damage the industry, even if the rumours are not true, but discouraging people, businesses, and industry from locating in the area. (T291:43827)

John Russell,
HUDAC - Ottawa

V - The Load Forecast and Information Base

The forecasting of peak load (kilowatts) and electric energy (kilowatt-hours) is the starting point in the electric power planning cycle. Because the basic requirement in the Commissions' Terms of Reference relating to the power needs for eastern Ontario is to assess Ontario Hydro's projections for the region to the year 1987, and from 1987 to 2000, a review of the process of load forecasting is necessary. The Commission's Final Report and supporting documents will address in considerable detail the techniques used to forecast the future demand for electricity in Ontario. We will do little more here than introduce the load-forecasting methodologies of Ontario Hydro and comment on the demand projections for the Eastern Ontario Region that were presented by Ontario Hydro to the Commission.

Three generic approaches to load forecasting are:

1. The goal-oriented approach - the load forecast is predicated on assumptions about a desired future.

2. The historical trend, or "bottom-up", approach - the load forecast is based on extrapolation of detailed records of customer usage. (A variant of this is the engineering approach which emphasizes the end-use data that are needed to analyse patterns of growth in electric load.

3. The macro-economic, or "top-down", approach - statistical methods are used to correlate changes in electricity consumption with trends

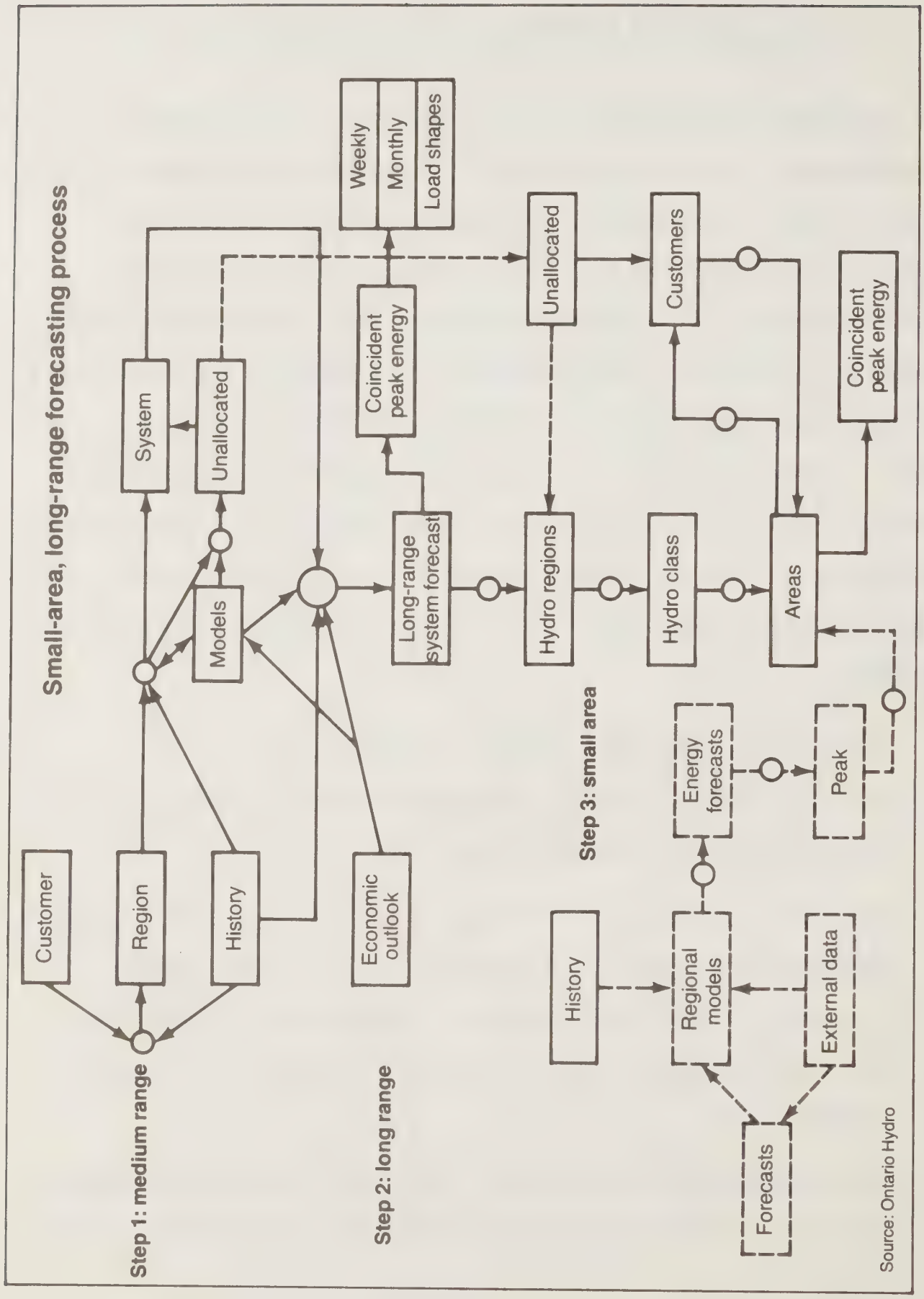

Small-area, long-range forecasting process
Step 1: medium range
Customer
Region
History
Models
System
Unallocated
Step 2: long range
Economic outlook
Long-range system forecast
Coincident peak energy
Weekly
Monthly
Load shapes
Step 3: small area
Hydro regions
Unallocated
Hydro class
Customers
Areas
Coincident peak energy
History
Regional models
External data
Forecasts
Energy forecasts
Peak
Source: Ontario Hydro

FIGURE 5.1

in various variables, such as per capita gross national (or provincial) product, employment, and the prices of electricity and others forms of energy.

The Load Forecasting Process

Ontario Hydro has for many years employed a modification of method (2), which is based on estimates provided by municipal public utility commissions (PUCs), direct industrial customers, and regional offices of Ontario Hydro (for rural-area loads). These estimates have an important role to play in short-term forecasting. Increasingly, however, and with the encouragement of the Select Committee on Hydro Affairs and the Ontario Energy Board, Ontario Hydro has been turning to econometric models, which rely to a considerable extent on general economic forecasts for long-term forecasts of load growth.

Figure 5.1 sets out, in the form of an information flow chart, the basic steps in the current Ontario Hydro forecasting process. These steps will be considered in depth in our Final Report. However, in summary form:

- Step one of the process combines the responses of the municipal and direct customers with Ontario Hydro's regional staff forecasts of rural area loads into a medium-range regional estimate of peak demand. Independently, an econometric model is used to generate a complementary forecast. The discrepancies between the two are reconciled by means of a judgement factor, referred to by Ontario

Hydro's senior load forecaster as the "unallocated load". This may be positive or negative. During the last two years, the regional forecasts have been adjusted downwards by many hundreds of megawatts to bring them into line with the predictions of the models. Although this indicates, in the judgement of the load forecaster, that most of the regional estimates will prove to be high, it was suggested that this may be a temporary phenomenon.

- Step two, the long-range forecast, also employs an econometric model that uses as input the medium-range forecast, historical data, and projections of the economic environment. For example, the 1979 forecast is for average annual growth rates of Ontario peak demand as follows: 1980-85 - 5.0 per cent, 1985-90 - 4.9 per cent, 1990-95 - 4.5 per cent, and 1995-2000 - 4.0 per cent.

- Step three, the small-area forecast, breaks the province-wide forecast of peak demand down by class of customer, by region and area, and by individual municipal PUC. Load-factor histories are introduced to translate the forecasts of peak demand into energy forecasts. A judgemental distribution of unallocated load is then made among the three main classes of customers - municipal, rural retail, and direct - and by class among Ontario Hydro's regions and areas. Ontario Hydro made it clear that, although there was little justification for spreading the unallocated load to each individual municipality, there was a demand for this type of precision. Further "disaggregation" to

individual transformer station loadings followed; indeed, it was this process that produced the 5 per cent per annum growth forecast for the Ottawa load area that is shown in Exhibit SW3, Appendix B, and in Fig. 9.6 of this report.

The boxes indicated with broken lines in Fig. 5.1 refer to some highly disaggregated class-of-customer models that are still under development by Ontario Hydro. These were not used in the 1979 load forecast. As described to the Commission (Report on the Need for Bulk Power Facilities in Southwestern Ontario, pp.42-44), one of these models will use forecasts of socio-economic variables such as population, income, household formation and appliance saturation to forecast energy demand in the residential sector. It will use a new and very detailed Statistics Canada survey of electricity consumption and other variables at the individual household level (the HIFE data base). Another will use Ontario Government economic data in specific sub-regional electricity models. An industrial model will assess, among other things, the impact of alternative time-of-day or seasonal rate structures on industrial customers. Less progress is apparently being made in the commercial sector because of a lack of data. Ontario Hydro witnesses stated that they are trying to rectify this deficiency by load surveys.

Special mention should perhaps be made of the SRI-CEA model, which, because it occupied many pages of the principal submission (Exhibit SE2), was assumed by a number of participants to have been a cornerstone of the eastern Ontario load forecast; the results of that forecast were heavily

criticized by those participants in their submissions. In fact, as Ontario Hydro pointed out in its "supplementary information" memorandum (Exhibit SE3), the SRI model was not used in the 1979 load forecast. However, its purpose was clearly stated by Ontario Hydro - for example, in Exhibit SE2: "the purpose of this mathematical model is to project the long term demand for electric energy by end use".

The Eastern Ontario Load Forecast

The Commission heard from six PUC managers and one Ontario Hydro area manager on the subject of the load-forecasting process in the Eastern Ontario Region. Some quotations from the record are cited in Section IV. Wayne Phillips of Nepean Hydro, for example, suggested that the concentration of attention on conservation has resulted in an "artificially low load growth over the past relatively short period", but that higher growth may resume as further conservation measures become more expensive and "less dramatic in impact". Indeed, the very diversity of these views could be said to support Ontario Hydro's contention that the strength of the "bottom-up" forecast is in the assumed randomness of the errors in the PUC and regional office load estimates. However, our findings in this connection, as set out in Section V of our Report on the Need for Additional Bulk Power Facilities in Southwestern Ontario, remain unchanged. We regard the survey of PUC and regional office opinion on electrical load developments as vital input to the load-forecasting process, but we maintain that inherent limitations in the process suggest that its principal usefulness will be for short-term forecasting. Nor can we overstress the value we

attach to the views of PUC and regional Ontario Hydro staffs concerning economic growth in general and developments in the energy scene in particular. But this only underscores the importance we place on better communication channels emanating from Ontario Hydro's head office.

As in the southwestern Ontario inquiry, the Commission conducted a confidential survey of the process used by Ontario Hydro's industrial customers in eastern Ontario in forecasting their power requirements. Not unexpectedly, the findings were similar to those reported in our Report on Southwestern Ontario (pp.34-5). Most firms reported that they could estimate electrical requirements fairly accurately for a year or two ahead on the basis of planned production levels. For longer periods, their forecasts usually has to be based on sales forecasts, which were less reliable.

The majority of the 13 industrial briefs received during the hearings provided straightforward assessments of the growth prospects of individual firms or industrial groups in eastern Ontario. Most of these supported the view of Queen's Professor Gerald Hodge to the effect that the prospects for industrial growth in the area were not promising in terms of employment, though there would be modest growth in the value of output through productivity gains. However, IVACO Ltd., whose L'Original plant near Hawkesbury has one of the largest power loads in eastern Ontario, was a notable exception. In its submission to the Commission, the company stated that it was forecasting an increase in its total peak demand of over 50 MW by 1987 - some 35 MW more than Ontario Hydro had expected. This

unexpected increase of 35 MW, if it materializes, will represent about 5 per cent of the total increase in power demand projected for the Ottawa area over the period 1984-7.

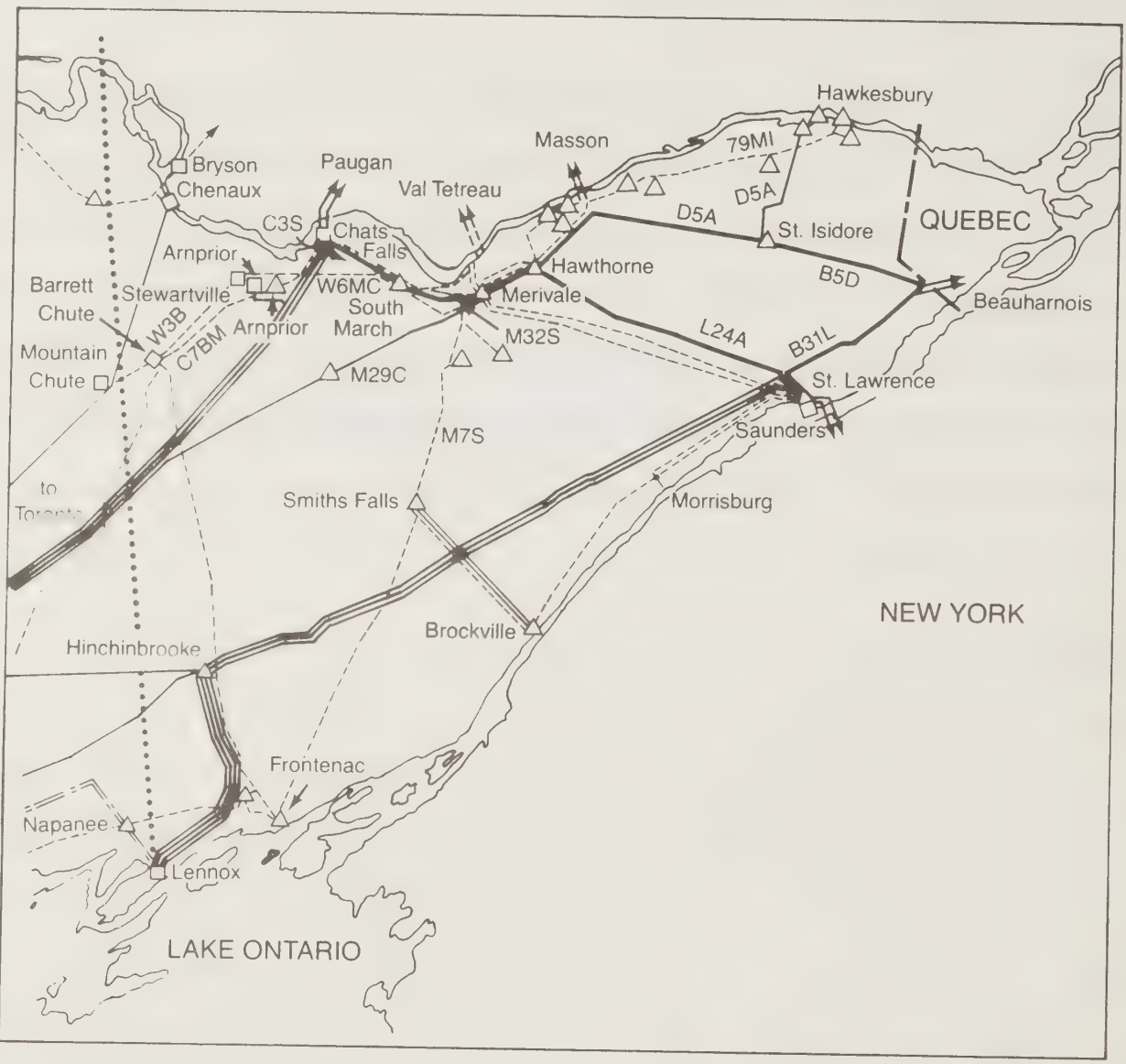
All official municipal representatives and industrial and Chamber of Commerce spokesmen (see Appendix D) were optimistic, in varying degrees, that industry would recognize the merits of locating in their community. However, some of this optimism was based on the expectation that a joint federal-provincial programme would dispense some $57 million over five years in DREE-type assistance to resource-based industry in the more depressed parts of the province, mainly in the east. To date (July 1979), no announcement of government plans in this regard has been made.

Several submissions by individuals and public interest groups impressed us with their thoughtfulness on the question of the regional load forecast. Professor Hodge (Exhibit SE18) argued for the use of standard geographic regions and data bases for load forecasting. Bunting and Tarcot (Exhibit SE27) placed a detailed series of load-related questions on the record, the answers to which, they argued, should form part of the official record of the eastern Ontario inquiry. (The Commission met informally with senior Ontario Hydro officials to discuss the questions we deemed most relevant to our inquiry.) PANDA (Exhibit SE30) presented a scenario which, it claimed, would lead to a 0.4 per cent per annum growth rate in electrical demand. Its brief contained case histories of eastern Ontario firms and institutions that have achieved significant levels of electrical energy conservation without much additional cost.

The Commission accepts the contention of Ottawa Hydro that the effect on its area load of the possible decentralization of the civil service would not be significant.

We have taken note of the Ottawa-Carleton official plan, in which provision is made for a number of sizeable new communities. We note, on the one hand, that Ontario Hydro forecast a 5 per cent per annum growth in the Ottawa area load and, on the other hand, that the population growth forecast for the area was recently significantly scaled down to 2.14 per cent per annum, which would mean a total regional population of 785,000 in 2001.

Eastern Ontario – Major Bulk Power Facilities



500 kV circuits
230 kV circuits
115 kV circuits
transformer stations
generating stations
study-area boundary
interconnections
critical circuits

Source: Ontario Hydro Exhibit SE2

FIGURE 6.1

VI - Bulk Power Facilities : Eastern Ontario

Ontario Hydro's bulk power facilities include the following types of major components:

- generating stations (hydraulic, fossil-fuelled, nuclear, gas-turbine - see Table 6.1 for facilities located in eastern Ontario)
- high-voltage transmission lines (500 kV, 230 kV, and 115 kV)
- transformer stations that convert bulk power from one voltage level to other voltage levels
- bulk power switching systems for the control and protection of the power system
- a central, computer-based control station (the Richview Control Centre)

The location of the major bulk power facilities in eastern Ontario is shown schematically in Fig. 6.1.

The peak capacity of the generating stations in the study region (3,769 MW, as indicated in Table 6.1) exceeds the sum of the present peak load in the region (in the order of 1,800 MW for 1978-9), and an allowance of 25% for the over-all system reserve. Assuming that the regional load grows as predicted in Ontario Hydro's 1979 Load Forecast, this situation will prevail until the mid 1980s (1985-6 load will be in the order of 2,700 MW). However, this does not mean that eastern Ontario is self-sufficient in generating capacity. In fact, it has been and remains a net importer of power.

Table 6.1. Installed Generating Resources within the Eastern Ontario Study Area

		Dependable January capability (MW)	
Hydraulic	Installation date	Peak	Average *
Galetta	1907	0.8	-
Merrickville	1915-19	0.9	-
Calabogie	1917	3.0	-
High Falls	1920	2.6	-
Chats Falls	1931	94.0	37.0
Barrett Chute and extension	1942 & 1968	172.0	13.0
Stewartville and extension	1948 & 1969	166.0	12.0
Chenaux	1950-51	116.0	45.0
R. H. Saunders	1958-9	734.0	582.0
Mountain Chute	1967	165.0	13.0
Arnprior	1976-7	78.0	6.0
Total		1,532.3	708.0
Oil: Steam-Thermal			
Lennox	1975-7	2,232.0	
Oil: Combustion Turbine			
Lennox	1975	5.0	
Aggregate installed peak capability including thermal		3,769.3	

Source: Ontario Hydro Exhibit SE3 and Ontario Hydro Power Resources Report No. 790201, February 1979.

* It is important to distinguish between peak and average capability in the case of hydraulic stations, because their energy output is limited by the quantity of water available over a given period. Average capability is defined as the total energy output over a period, divided by the length of the period.

For several decades, until the last contract expired in June 1977, an important share of eastern Ontario loads were met by firm power purchases from Hydro Quebec. These contracts having expired, the region has grown increasingly dependent on supplies of power from stations in central Ontario.

In contrast to the situation in southwestern Ontario, generating capacity in eastern Ontario is predominantly hydraulic. Two of the hydraulic stations listed in Table 6.1 (Chenaux and Mountain Chute), are connected to Ontario Hydro's main bulk power grid in the Peterborough area and have no role in supplying loads in the study area. Farther up the Ottawa are the Des Joachims and Otto Holden hydraulic stations which supply loads in central and north-central Ontario. Ontario Hydro argued that major new transmission facilities would be required to connect this generation capacity to the Ottawa area and that, even so, such action would not significantly reduce the need for reinforcement of the transmission system connecting the Ottawa area to the main part of the bulk power grid.

Of the other stations listed in Table 6.1, R. H. Saunders, Chats Falls, Barrett Chute, Stewartville, and Arnprior play an important role in supplying loads in the study area. Saunders, on the St. Lawrence River at Cornwall, is primarily a base-load plant; it has an annual capacity factor (ACF) in the order of 85%. Chats Falls, on the Ottawa River 55 km upstream from Ottawa, is an intermediate-load plant with an ACF of approximately 55%. Barrett Chute, Stewartville, and Arnprior, all on the Madwaska River, are

used for peaking and spinning reserve purposes and have ACFs of less than 10%. The oil-fired Lennox steam-thermal plant, although capable of base-load operation, is used primarily for peaking and reserve because of the high cost of residual fuel oil compared with the cost of the coal or uranium used by thermal stations elsewhere in the system.

The backbone bulk power transmission voltage in eastern Ontario today is 230 kV (Fig. 6.1). Most important are the circuits connecting transformer stations (TS) in the Ottawa area (Merivale and Hawthorne) to R. H. Saunders Generating Station (GS) and Chats Falls GS, the circuits connecting Saunders GS with Lennox GS via Hinchinbrooke TS, and the circuits emanating from Chats Falls, Merivale, and Hinchinbrooke and proceeding southwest towards Toronto (Cherrywood TS). Interconnections with neighbouring systems, which affect power supplies in the eastern Ontario area, include a double-circuit 230 kV tie to the New York Power Pool (NYPP) at St. Lawrence TS, and ties to Quebec at Beauharnois (2 x 230 kV) near Montreal, and at Masson (2 x 115 kV), Val Tetreau (2 x 115 kV), and at Paugan (2 x 230 kV) in the Ottawa area. The interconnection at Val Tetreau, however, is not in service at present and will be permanently decommissioned by Hydro Quebec after 1984. (See Section X for details).

Ontario Hydro considers that existing transmission east from Lennox on to Saunders (over which the power now generally flows east rather than west) is adequate to serve the communities along the St. Lawrence River, but it is very concerned that the existing transmission into the Ottawa area is inadequate. Ottawa and its environs are now dependent for supply

mainly on three 230 kV lines; one from Chats Falls to the northwest; one direct from Saunders to the south; and one which comes from Saunders along a more circuitous route to the east. Each is considered critical by Ontario Hydro. The very long 230 kV line from Toronto into Ottawa is not heavily loaded and thus not considered critical. Nor are the 115 kV lines which play modest roles in supplying the Ottawa load.

We will discuss in Sections IX and X the adequacy of these generating facilities and the associated transmission facilities for the loads that must be supplied in the Eastern Ontario Region.

VII - Notes on Reliability

The reliability of an electric power system may be defined, briefly, as the system's ability to meet the demand for power while maintaining acceptable frequency and voltage levels. An electric power system is composed of generating stations, bulk power transmission lines, and a distribution network, and the reliability of supply to the customer depends on the reliability of each of these subsystems.

The reliability of a generation system is to a large extent predicated on the availability of individual generating units. Since availability is affected by both planned and forced shut-downs, or deratings, of units, generation reliability cannot be stated quantitatively except in terms of probabilities. The most widely used reliability index is the one called the "loss-of-load probability" (LOLP) index. In simple terms, this is the expected number of events over a specific period (say a year) during which the load on the system will exceed the available generating capacity. For a given availability of generating units, the generation reliability increases with the amount of reserve generating capacity that can be called upon when one or more generating units go out of service. This reserve capacity is usually referred to as "reserve margin", and it represents the difference between the generating capacity and the peak demand, expressed as a percentage of the peak demand.

Until quite recently, Ontario Hydro's policy was to plan generating capacity to meet an LOLP of about 1 in 2,400 in the month of December. This

corresponds to a loss of load on one working day in 10 years (on the basis of 240 working days per year).

As a result of a study undertaken to evaluate the costs and benefits of reliability, Ontario Hydro appears to have changed the generation reliability target from an LOLP of one day in 10 years to an LOLP of five days in 10 years (see Ontario Hydro's "1979 Review of Generation Expansion Program", March 1979, Section 3.0). We also note that Ontario Hydro has recently developed a new reliability evaluation programme based on the "frequency-and-duration-of-outages" method.

Whereas the availability of a typical large thermal generating unit is in the order of 75%, the availability of Ontario Hydro's bulk power transmission system is generally much higher - about 99%, in fact.[1] A second aspect of reliability, one that is not very significant in the evaluation of generating system reliability but critical in transmission reliability, is "security". The security of a bulk power transmission system is related to its stability, and is a measure of its ability to withstand major disturbances (caused, for example, by the sudden loss of a transmission line in a storm) and settle down to an acceptable operating state. Some of the security considerations involved in transmission system planning will be discussed in Section VIII.

Historically, only a relatively small proportion of electric power outages have been due to failures in the bulk power system (generation and transmission). However, failure of the bulk power system due to

inadequate generating capacity or to a transmission-line breakdown may lead to a large-scale rejection of load on a regional scale, while failure of a component or line in the distribution system normally gives rise to a local outage only. A major regional electric power outage is generally the result of a failure of the system to respond rapidly enough to sudden major changes in load or to line outages caused by a storm or by lightning.

While it is comparatively easy to determine the cost of providing electric power, it is much more difficult to assess the economic consequences of interruptions of electric power to specific customers. Perceptions of the cost of a power interruption differ widely among the various classes of customers. Ontario Hydro recently carried out a customer survey and published the estimated costs of electric power outages of varying duration in respect of selected classes of customers (see Figure 7.1). Note the tentative conclusion that the agricultural and industrial sectors of Ontario's economy are the ones that are most sensitive to electric power outages. Concern about the importance of adequate reliability of electric supply was expressed very forcibly to the Commission in submissions by farmers, industrialists, and municipal officials, as well as by a hospital administrator and a university plant manager (see Section IV).

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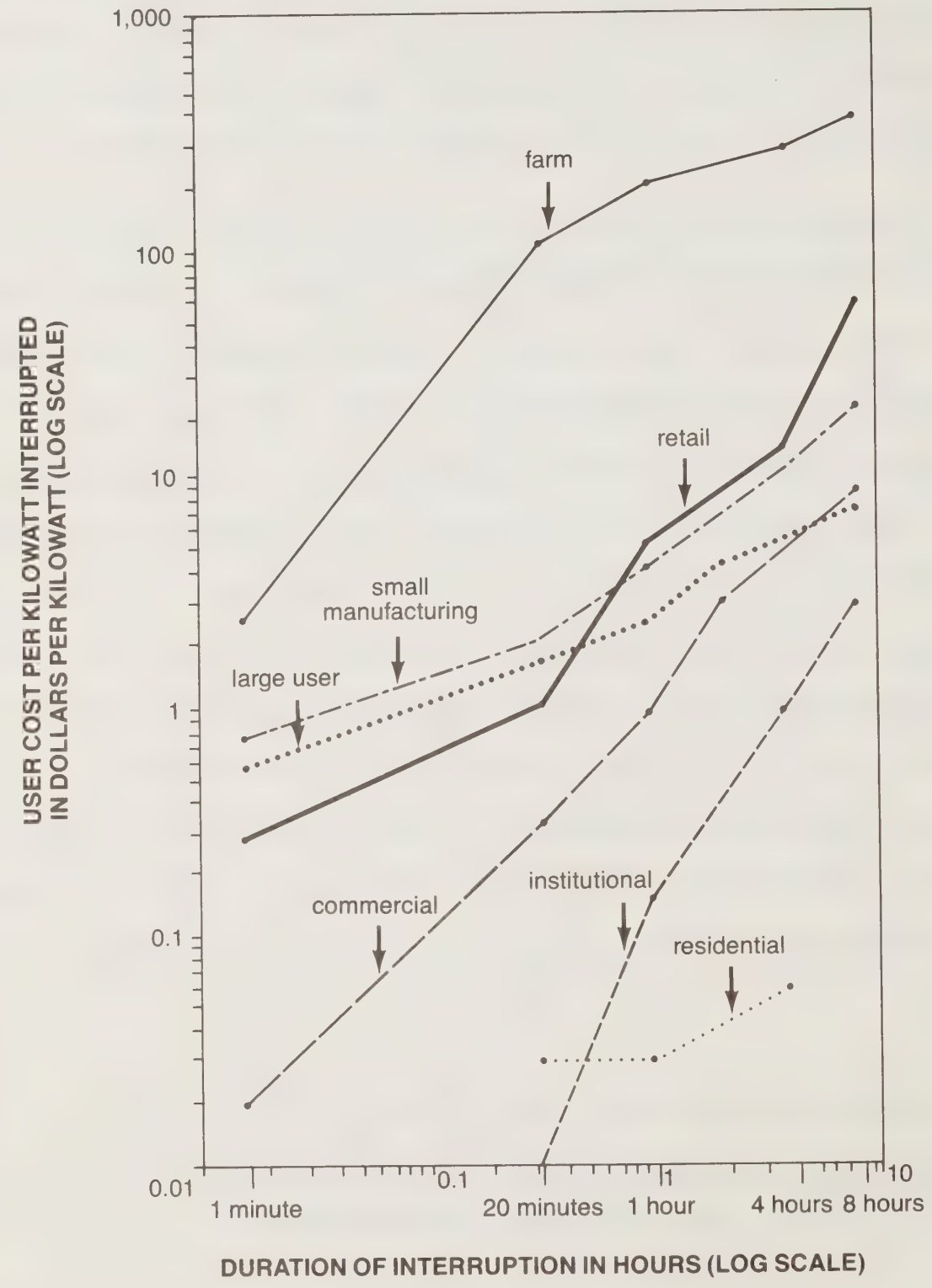
[1] Ontario Hydro memorandum to Royal Commission on Electric Power Planning, "Reliability", Public Information Hearings, May 1976.



Source: Ontario Hydro

FIGURE 7.1

VIII - Elements of Transmission Planning

Like most large electric utilities, Ontario Hydro maintains an integrated power system in which all major generating stations feed into a high-capacity bulk power transmission system. This is a network of high-voltage transmission lines that extend throughout the province. At one time the bulk power transmission system comprised lines operating at 115 kV; but this was subsequently reinforced with an overlay of 230 kV lines; and it is now being reinforced again with an overlay of 500 kV lines.

The bulk power transmission system supplies power to transformer stations situated near the various load centres. At a transformer station the power is transformed to a lower voltage, usually to a subtransmission voltage (13.8 kV, 27.6 kV, or 44 kV). Subtransmission lines then take the power on to distributing stations where the power is again transformed to a distribution voltage (usually 4.16 kV, 8.32 kV, or 12.48 kV). Finally, distribution lines take the power along individual streets, where it is again stepped down, usually through pole-mounted transformers, to utilization voltage and delivered to individual customers. Sometimes the subtransmission level is bypassed, and the power is transformed directly from the transmission level to the distribution level.

An integrated power system inherently requires a strong and extensive high-voltage transmission network, which must be reinforced periodically to keep step with increasing concentrations of loads and

generation. The integrated system permits generation to be concentrated in favourable sites, and full advantage to be taken of economies of scale. The transmission system should allow the generating stations throughout the system to supply the total system load with maximum economy. As the total system load varies over its characteristic hourly, daily, and seasonal cycles, the power plants feeding the system are operated in "merit order" so as to minimize total fuel costs.

The integrated power system permits the power production facilities to be redeployed as necessary to supply unanticipated demands for power and to accommodate fluctuations in hydraulic inflows, shortfalls in coal deliveries, and other variations in loads and resources. It permits uninterrupted supply to the load centres at times when generating units or transmission-line elements are removed from service for routine maintenance or forced out of service due to equipment malfunctions or lightning, wind or storms. The requirement for generation reserves is substantially reduced.

Ontario Hydro's bulk power transmission system is interconnected with similar systems in neighbouring states and provinces and they, in turn, are interconnected with their neighbours. Benefits similar to those that are realized within the Ontario Hydro system are thereby realized through inter-utility transactions on a region-wide basis. Most provincial and state electric utility systems in North America are interconnected, but the Hydro Quebec system is a noteworthy exception, as discussed below.

Criteria for Planning

The bulk power transmission system should be robust and flexible. It should be able to accommodate anticipated and unanticipated shifts in power production and utilization. Ample transfer capability should be maintained with neighbouring systems to facilitate mutual assistance in emergencies and to realize economic benefits through planned and opportunity purchases and sales of power and energy. A high level of reliability is essential, since serious malfunction can lead to extensive and prolonged blackouts.

A bulk power transmission system is a highly complex mechanism. A severe system disturbance may arise unexpectedly, as during a storm. Automatic protection and control devices are called upon to alleviate the disturbance within a fraction of a second - far more rapidly than human response is capable of. The system must be robust to be able to tolerate the element of equipment malfunction and human fallibility.

The electric utility industry has developed broad criteria for bulk power transmission system planning. These require that the system perform adequately during certain postulated events that are severe but credible. The system is expected to be able to tolerate such events. The main objective, however, is to endeavour to ensure sufficient flexibility and robustness to accommodate the unexpected.

In the final analysis, the planning of a bulk power transmission system requires the exercise of mature judgement based on broad experience,

together with extensive analytical studies. As implied in the previous section, the reliability of an integrated power system can be facilitated by introducing an adequate degree of redundancy in the system. In the case of the system's generating capacity, this can be quantified readily in the form of the reserve margin. However, no corresponding index of reserve capacity is available, or indeed practical, for the bulk power transmission system.

Standards of Security

Following a major disturbance that may be caused by a transmission-line fault, the loss of a large generator, or a sudden change in system load, the bulk power system experiences a period of adjustment. During this transient period, the power flows and voltages across the system are changing continuously as the system seeks a new operating state satisfying the changed conditions. The security of the system is defined as its ability to remain stable during the transient period as well as to settle down to an acceptable operating state. An acceptable operating state implies that the current flows and voltage levels across the system should remain within prescribed limits. In the eastern Ontario study area, as we will discuss later in this section, instability is not the main concern. The supply capability of the eastern Ontario bulk power system is limited less by considerations of stability than by the problems of line overloadings and voltage control following a postulated contingency.

From the viewpoint of stability, a cardinal rule in electric system planning is to isolate and confine a disturbance and prevent it from

spreading. With high-voltage, high-capacity, interconnected transmission systems, it is necessary to ensure against the occurrence of cascading interruptions due to system instability, which can lead to widespread blackouts.

All of the generating units on the Ontario Hydro system, and on all the systems with which it is interconnected, operate in synchronism, rotating at speeds that are in lock-step with the North American standard frequency of 60 cycles per second. It is essential that all the generators stay in lock-step. If generators go out of synchronism, violent swings in generator and power-line loadings occur and the troublesome elements must be removed from service. If such disturbances are widespread the system may, quite literally, shake itself apart.

When a generator is in equilibrium at synchronous speed the electrical power output equals the mechanical power input. The power output may be adjusted by opening or closing the throttle, or gate, and a new position of equilibrium is normally established. Under normal conditions stable operation is assured, and any small random departures from equilibrium are self-correcting. If, for instance, the machine speeds up slightly, the electrical output increases immediately, whereas the mechanical input remains unchanged due to inertia. With output in excess of input, the machine slows down and returns to equilibrium. If, however, the output of one or more generators is fed into a long and excessively loaded transmission line, this inherent stability is lost. If the machines speed up momentarily,

the electrical output decreases and the machines continue to speed up and go out of step. This is known as dynamic instability.

If a major fault occurs near a large generating station, the electric power output drops immediately to nearly zero while the mechanical power input continues as before. The generators accelerate well beyond their normal points of equilibrium. Provided that the fault is cleared promptly, and provided that the system was not "stretched" excessively prior to the event, equilibrium will be restored. Otherwise, the generators will accelerate out of step and must be removed from service.

The National Electric Reliability Council (NERC) was established in the wake of the massive 1965 northeast power blackout (which was due to transient instability) to promote, through co-operative efforts of its member utilities, system practices that minimize the risk of cascading interruptions. Ontario Hydro is a member of NERC through affiliation with one of its regional councils, the Northeast Power Co-ordinating Council (NPCC). The criteria set by NPCC require that stability be maintained through various severe but credible contingencies, such as the loss of two major transmission lines at the most vital points in the system.

The NPCC criteria are applied by Ontario Hydro to the design and operation of those parts of the system in which the occurrence of a system disturbance could result in cascading outages and widespread interruptions in the remainder of the Ontario system and in the systems of the interconnect utilities. Because of their location with respect to the rest of Ontario Hydro's system, a disturbance to the critical 230 kV circuits in eastern

Ontario would not affect the integrity of the main interconnected systems, and, accordingly, Ontario Hydro has adopted a less stringent design and operating criterion for those facilities. This criterion requires that acceptable voltages and loading conditions be maintained after the overlapping loss of any two elements of the bulk power system. The criterion allows for adjustment of generation between the occurrence of the first and second outages. It should be pointed out that all the critical bulk power lines feeding loads in the Ottawa area are single circuit on separate rights-of-way. To a certain extent this facilitates security of supply to Ottawa even under the less stringent security criterion.

Interconnections

Substantial benefits can be obtained by exchanging power and energy between interconnected power systems. The nature of the benefits depends upon the characteristics of the interconnected systems, the transfer capability that the interconnections provide, and the understandings that are reached in respect of interconnection transactions. An interconnection transaction may fit one or more of the following categories:

emergency assistance

economy energy

short-term capacity sales

firm power

wheeling service

storage service

diversity exchange

and unit participation or shared ownership of a generating unit. Further consideration will be given to these options in the Commission's Final Report and supporting research reports.

In the United States, regional groupings of utilities into power pools are supplanting bilateral utility-to-utility transactions. In addition to facilitating transactions such as the foregoing, power pools may provide for co-ordinated operations, in which all of the generating stations of the member utilities are dispatched centrally. Requirements for generation reserves are reduced when systems are interconnected, and some power pools have established bases for the sharing of such reserve benefits. Other pools co-ordinate the planning of the member systems to varying extents.

Interconnections provide benefits through both cost reductions and improved service. Inter-utility transactions also have important connotations for over-all public policy, especially when they are of an international or interprovincial nature. Interconnections facilitate a flexible response to an uncertain future, as far as energy resources and energy demands are concerned.

Ontario Hydro is interconnected with the Michigan Power Pool at Windsor and Sarnia, and with the New York Power Pool at Niagara Falls and Cornwall. The nominal interconnection capacity at Cornwall is 720 MVA; whereas it is 1,030 MVA at Niagara Falls and 2,855 MVA at Sarnia and Windsor. Upon occasions, power imports from the United States have helped Ontario Hydro through critical supply shortages. In recent years, however, the

financial advantages to Ontario Hydro have been considerable: net profit was $245 million on export sales of 23,000 MW.h in the three years 1976-78. With large generating capacity surpluses projected through the 1980s, Ontario Hydro is currently seeking opportunities for medium-term firm power exports.[1]

Several high-voltage transmission lines cross the interprovincial boundary between Ontario and Quebec, but these are not interconnections in the full meaning of the term. Hydro Quebec purchases large amounts of power from Churchill Falls Generating Station (GS) in Labrador, and transmits it to Montreal and intermediate points. Other long transmission lines are being built to connect the large hydroelectric stations on the La Grande River in the James Bay region to load centres in southern Quebec. It is not feasible to operate the Hydro Quebec system in synchronism with neighbouring systems in Ontario, New York, New England, and New Brunswick (all of which are in synchronism with each other), due to stability limitations imposed by these long and heavily loaded lines. Power can be transferred from Quebec to Ontario only through the cumbersome expedient of disconnecting certain generators, mainly at Beauharnois GS from the Hydro Quebec system and connecting them to the Ontario Hydro system. Ontario can supply Quebec by isolating units at the Saunders GS and then connecting them to the Hydro Quebec system. Since the expiration of the long-term contracts between Ontario Hydro and Hydro Quebec in May 1977, interchange capability between the two has become increasingly constrained as load growth on both sides of the border has preempted the limited transmission capability available for power transfers.

Voltage Control

Stability usually limits the amount of power that may be transmitted on long lines (over 300 km) and may be a limiting factor on lines of intermediate length (100-300 km). Current-carrying capacity limits the amount of power that can be transmitted on short lines (0-100 km) and may be a limiting factor on lines of intermediate length. Excessive current may overheat the conductor and anneal it, causing a permanent loss in mechanical strength. The conductor expands when hot. It may sag excessively and come dangerously close to the ground.

Under some circumstances, especially with lines of intermediate length, voltage control may impose more severe constraints than either stability or current-carrying capacity. According to Ontario Hydro, Figs. 9.4 and 9.5 are broadly illustrative of North American electric utility practice regarding transmission line loading limits. (See Section IX).

Ontario Hydro must ensure that it supplies its customers with a product of acceptable quality. The primary requirement is that it maintain an acceptable voltage at the point of delivery to each customer. Electricity is a demanding product in that delivery voltages must be neither too high nor too low. Voltages across the system must be held within relatively narrow bounds, despite great variations in power-delivery requirements. At residential service entrances it is desirable to hold the delivery voltage within a 10 per cent range, although occasional variations beyond this range are tolerable if limited in frequency, extent,

and duration. Water and natural gas delivery systems can tolerate much greater proportionate variations in delivery pressures.

Due to the impedance of transmission lines (a function of its resistance and reactance), there is an inherent tendency as power demand (and hence current flow) increases for the delivery voltage to decrease. This must be compensated for in order to keep the delivery voltage within an acceptable range as the customer's demand varies from no-load to full-load. The main mechanism for controlling delivery voltage is the use of tap-changing transformers at the transformer stations. For instance, a transformer station may step the voltage down from 230 kV to a nominal 13.8 kV, but a tap-changer permits this output voltage to be adjusted up or down by 10 to 15 per cent. At full load the tap-changer is used to "boost", or increase, the nominal voltage (say 13.8 kV); at light load it is used to "buck", or reduce, it.

The preferred practice is to keep the transmission system voltage relatively constant at the transformer stations. Voltages can be adjusted for this purpose at the generating stations, to a limited extent. Voltages are increased at high output and decreased at low output to compensate for voltage drops in the transmission system and to maintain a steadier voltage at the transformer stations.

Another way of controlling voltage is through the use of reactive power sources such as static capacitors, synchronous condensers, and static compensators. Static capacitors are relatively commonplace, and relatively inexpensive, the other two are not as common and much more

expensive. Capacitors are static devices that can be assembled like building blocks into small or large "banks". They are commonly sited near the load and are usually at lower system voltages. Small banks are commonly used to help sustain the distribution voltage levels. Such small banks may be kept energized continuously, if only because it is costly to provide for switching them. Medium-sized banks may be switched on a daily or seasonal basis in response to load patterns. In contrast to tap-changers, which are basically used for "fine tuning" the voltage, capacitors serve to boost or raise the voltage in large discrete steps at the point of application. However, the boosting effect varies with conditions in the system, and a capacitor bank of a particular size may provide excessive boost at light load and insufficient boost at heavy load. Capacitors are versatile and flexible, but they must be installed with careful attention to local needs.

Voltage control using reactive power sources becomes necessary when voltage variations get outside the 10 to 15 per cent range of tap-changers. This may happen when a transmission contingency forces one or more already heavily loaded circuits out of service. This causes the circuits still in service to overload, thereby increasing the active as well as the reactive power absorbed by these circuits. The reactive power produced by a transmission line is proportional to the voltage and does not increase. To compensate for the additional reactive power absorbed by the circuits, and to maintain satisfactory voltage, reactive power sources must be provided at the delivery points.

For smooth and effective voltage control, the switching of capacitor banks and the operation of tap-changers must be automatic and prompt. If the power system is heavily loaded, these controls must be sophisticated and "intelligent" to avoid the possibility of "voltage collapse". Voltage collapse can occur if the requisite number of capacitors are not switched on immediately after the loss of a transmission line or other major element. This tendency may be exacerbated by the action of the automatic tap-changers. The loss of a line, for example, causes the voltage in the load area to drop. When the voltage drops, the power demand also drops, which alleviates the situation somewhat. If the right complement of capacitors is not switched on promptly, the tap-changers automatically go to full boost to raise the delivery voltage. This increases the power demand and thus the current flowing through the transmission lines. The system is in such a state that each increment in voltage on the load side of the tap-changer causes a bigger drop in the voltage across the lines and consequently a larger reduction in the voltage on the primary side of the tap-changer. This unstable situation inevitably leads to a voltage collapse in the whole load area.

There is a power limit for a transmission line beyond which no reserve of reactive power sources can hold the voltage to a tolerable level. Also, as we have seen, automatic capacitor switching, while essential to prevent voltage collapse in some situations, can, ironically, precipitate a collapse if the switching is not precisely in accordance with predetermined criteria - and there is an increasing risk of this happening. On the matter of relying on automatic capacitor switching

to control voltages, Al Watson of Ottawa Hydro said:

> We don't want to operate a system like that and I am not too sure how well we can do it. We haven't operated a system where we are on the edge of a precipice where the voltage slides out from under us and frankly I don't know anyone else that really operates up in that area. It is strange. It's unusual. It is far beyond what good judgement would say is a way to operate a power system. (T294:44179)

Utility Transmission System Practice

The preceding sections have discussed the limits to transmission line loadings that are imposed by stability requirements, and by maximum permissible current and by the requirement to achieve acceptable voltage levels. Under normal circumstances the more stringent the reliability criterion, the lighter the loadings. The maximum permissible loading tends to be higher on a short line than on a long one. It tends to be determined by current limits for a short line, by stability limits for a long line, and by voltage limits for a line of intermediate length. These limits vary with the over-all system configurations and conditions of a system, however. It is not at all unusual for the capability of an interconnection to vary with the direction of flow.

For very long lines, economic considerations favour line loadings up to the stability limit. For other lines it is generally desirable, in the long run, in the interest of minimizing system losses, to operate well below the capability limits. Losses increase rapidly with increases in line loadings. If the capital costs of generating capacity and the annual costs of fuel to supply losses are taken fully into account, the economic burden of excessive line losses looms large.

Notes

1. On the basis of its 1979 load forecast, Ontario Hydro is projecting generating capacity surpluses, over and above its planned 25 per cent reserve margin, of 3,400 MW to the mid 1980s, falling off to zero around 1990.

   On the basis of its 1978 load forecast, Ontario Hydro estimated that it would have available 2,000 MW of generating capacity for firm power export sales through to the late 1980s and 4,000 MW or more for sales with an availability of 95 per cent. Ontario Hydro "Total Electric Power System", Submission to RCEPP, October 1978, Exhibit 375, p. 12.

IX - Adequacy of Bulk Power System in Eastern Ontario

Specific problems related to the planning of the bulk power transmission system in eastern Ontario are addressed in this section. The portion of Ontario Hydro's total transmission system that is shown in Fig. 6.1 supplies transformer station loads within the region from generating stations situated both inside and outside the region. To a lesser degree, it also delivers the output of generating stations within the region to transformer stations outside the region. Further, it permits the transfer of power to or from the New York Power Pool and the Hydro Quebec systems. Accordingly, the bulk power transmission system in the Eastern Ontario Region is associated with resources both within the region and outside it, in the neighbouring interconnected systems.

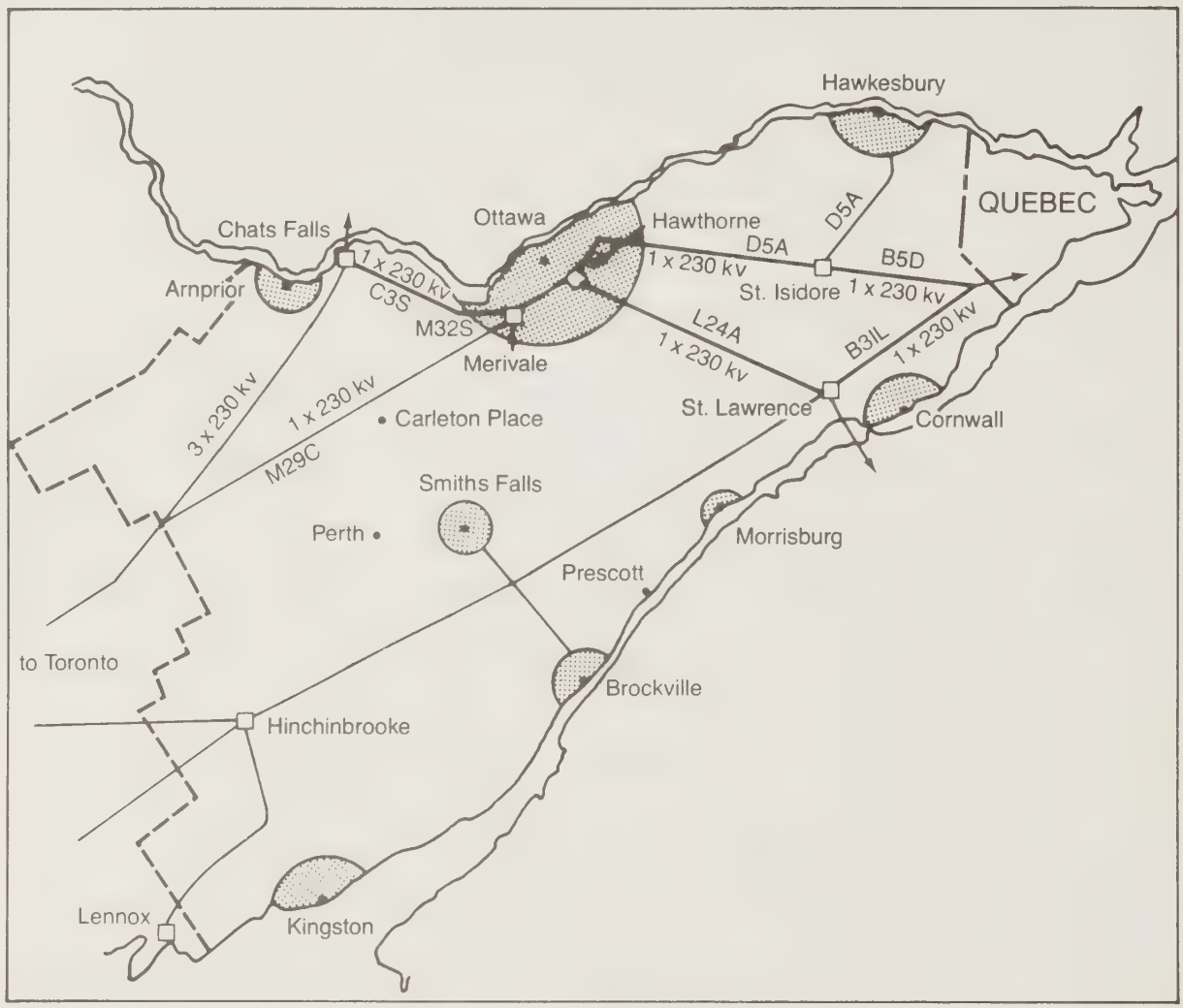
During the Commission's hearings, special attention was focused on the adequacy of that portion of the bulk power transmission system that supplies loads in the Arnprior, Ottawa, and Hawkesbury area. In this section, we will present Ontario Hydro's position on this matter and then give our own observations.

Ontario Hydro's Case

From studies it has undertaken concerning the capability of the bulk power system to supply loads in the Eastern Ontario Region, Ontario Hydro has concluded that:

> ...the existing system can supply a reasonable, a normal level of security until 1982, [assuming a load growth of

Eastern Ontario – Load Distribution and Principal 230 kV Lines



—— critical circuits

Source: Ontario Hydro Exhibit SE12

FIGURE 9.1

> about 5 per cent per annum and reliance on automatically switched reactive power sources to maintain voltages] and a reduced and less than desirable level of security until 1989. Beyond 1989 unless additional bulk power facilities are installed the level of service security will become extremely poor. (T279:42580)
>
> The earliest possible time by which major new bulk power transmission facilities could be installed to increase the power supply to the Ottawa area is 1986. Planning should therefore proceed now to enable new facilities to be placed in service as expeditiously as possible. (SE2:18)

The shaded circles in Fig. 9.1 give an impression of the distribution of load in the Eastern Ontario Region and the lines show the principal 230 kV circuits serving this load. The Arnprior, Ottawa, and Hawkesbury area loads, referred to for convenience as the "Ottawa area load", account for about 60 per cent of the load in the Eastern Ontario Region and are considered critical by Ontario Hydro. The reasons are clear when we examine the manner in which these loads are connected to the bulk power system. For example, as shown in Fig. 6.1, the Hawkesbury load is fed by a 115 kV circuit from Ottawa (79MI) and by a 230 kV circuit (D5A) tapped off at St. Isidore Transformer Station (TS) from one of the 230 kV circuits feeding Ottawa. The Arnprior load is fed from the 115 kV circuits (C7BM and W6MC) connecting Barrett Chute Generating Station (GS) and Stewartville GS to the Ottawa area. Both the Arnprior and Hawkesbury loads increase the loadings on the circuits supplying Ottawa and cannot readily be served in any other way. They are therefore treated as part of the Ottawa area load. The 115 kV system can be operated in such a way that Barrett Chute GS and Stewartville GS feed into the Ottawa area load. The remainder of the 115 kV network supplies very little bulk power to the Ottawa area.

The Ottawa area also has 115 kV transmission ties to Quebec at Val Tetreau and Masson both in the Hull area. These ties are usually open because it is impractical to operate the Ontario and Quebec systems synchronously connected (see Section VIII). The ties could be used in emergencies to supply isolated loads in the Ottawa area from the Hydro Quebec system. However, Hydro Quebec has stated that it can promise no firm power over these ties at any time in the future. Also, the Val Tetreau ties are to be decommissioned in 1984 as a result of an agreement between Hydro Quebec and the National Capital Commission. The role of interconnections in supplying the eastern Ontario loads will be discussed in greater detail in Section X.

The main electricity supply to the Ottawa area is from the 230 kV network via the following single-circuit transmission lines, shown on Fig. 9.1:

C3S-M32S	from Chats Falls
M29C	from Cherrywood TS (Toronto)
L24A	from St. Lawrence TS
B31L-B5D-D5A	from St. Lawrence TS

Ontario Hydro refers to C3S-M32S, L24A, and B31L-B5D-D5A as the "critical circuits" because the loss of any one of them would overload the others. M29C is not considered critical because it is a long circuit (about 300 km) and thus will not load up to a level that exceeds its rating.

To provide reasonable security of service on an interim basis, Ontario Hydro has under way an extensive programme to upgrade (i.e., increase the current-carrying capability, or "ampacity", of) the main 230 kV and 115 kV lines into Ottawa. This upgrading programme consists of various combinations of what Ontario Hydro terms "stop-gap" measures, as follows:

- restringing lines with heavier conductors with higher current ratings
- raising towers by adding extensions
- retensioning conductors to allow them to operate at higher temperatures
- replacing angle and anchor towers with stronger towers on new foundations.

The ampacity of the transmission lines in the programme before and after the stop-gap work is shown in Table 9.1.

Major transformer and switching stations are also being upgraded and the stop-gap measures include replacing or uprating current-carrying parts of station equipment such as circuit-breakers and line disconnects. About half the stop-gap work required for line and station uprating has been completed and most of the remainder is scheduled to be finished in 1980. The total cost of the line and station stop-gap work is expected to be about $22 million. Ontario Hydro considers this upgrading to be vitally necessary but acknowledges that it will have the side effect of reducing the reliability of the upgraded circuits.

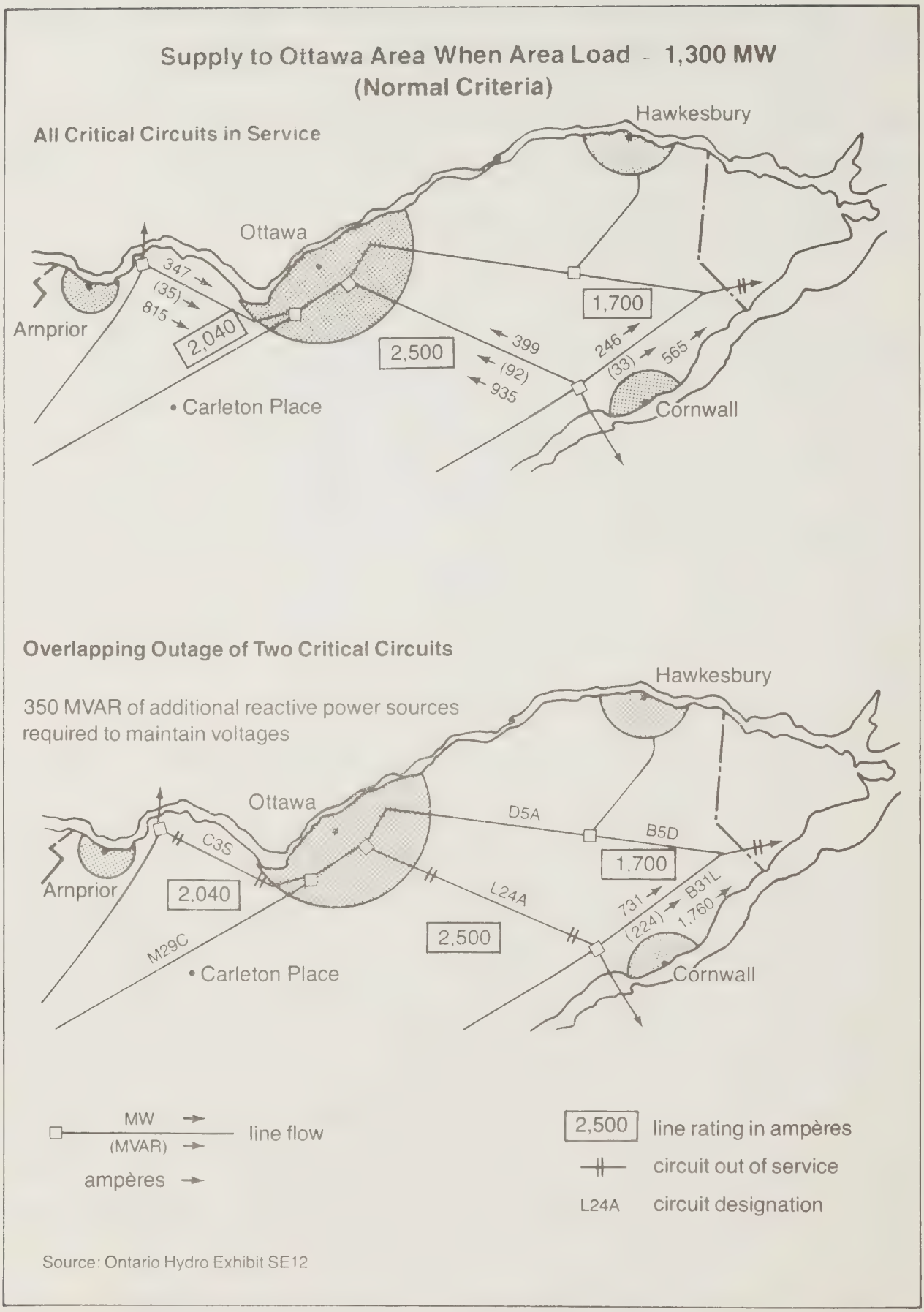
Table 9.1 Summary of Stop-Gap Work to Increase the Ampacity of Transmission to Supply the Ottawa Area Load

	Ampacity (amperes)	
	Before uprating	After uprating
230 kV circuit C3S Chats Falls GS - South March TS	1,030	2,040
230 kV circuit M32S South March TS - Merivale TS	1,030	1,700
230 kV circuit L24A St. Lawrence TS - Hawthorne TS	1,330	2,500
230 kV circuit B31L St. Lawrence TS - Interprovincial Boundary	1,330	1,700-1,900
230 kV circuit B5D Interprovincial Boundary - St. Isidore TS	1,290	1,700
115 kV circuit C7BM Barrett Chute GS - Fitzroy Junction	560	1,000
115 kV circuit C7BM Fitzroy Junction - Merivale TS	730	900
115 kV circuit W6MC Stewartville GS - Arnprior Junction	910	1,230
115 kV circuit W6MC Arnprior Junction - Merivale TS	730	1,000

Source: Ontario Hydro Exhibit SE2 (Figs. 16 and 17) and SE3 (App. 1).

Using the upgraded ratings of the critical transmission lines and considering the additional support of the 230 kV line M29C together with the full output of the local generating stations (Barrett Chute and Stewartville), Ontario Hydro has conducted load-flow studies to determine the maximum load that could be carried in the Ottawa load area.

As indicated in Section VIII, Ontario Hydro's normal security criterion for supplying the Ottawa area load is that supply should be maintained at acceptable voltage levels following the overlapping outages of two major bulk power elements (transmission lines, transformers, circuit breakers, etc.). The capability of the existing transmission facilities to supply the Ottawa area load after the upgrading programme has been completed has been calculated by Ontario Hydro, for normal security conditions, to be that shown in Fig. 9.2. For an Ottawa area load of 1,300 MW, the top half of the figure shows the line flows (power in megawatts, reactive power in megavars, and current in amperes) with all critical circuits in service, and the bottom half of the figure shows the line flows with an overlapping outage of circuits C3S-M32S and L24A. (It should be noted that, due to local generation and the power flowing over M29C, the total power being carried by the critical circuits is less than the Ottawa area load.) Also shown, for comparison, are the current-carrying capabilities of the critical circuits. As may be seen, the current rating of circuit B31L (1,700 amperes) has been exceeded under the double-outage contingency. Fig. 9.2 also shows that in order to maintain satisfactory voltage in the load area it is necessary to add



Source: Ontario Hydro Exhibit SE12

FIGURE 9.2

350 MVAR of reactive power sources within the load area (see Section VIII). Thus, the limit of supply to the Ottawa load area under the normal security criterion is a little under 1,300 MW, with all critical circuits uprated and with the availability of an additional 350 MVAR of reactive power.

Ontario Hydro has also completed load-flow studies in connection with the supply to the Ottawa area under a reduced security criterion requiring maintenance of supply at an acceptable voltage with the outage of only one major element. The results are illustrated in Fig. 9.3. With the loss of circuit L24A, the current in circuit C3S approaches its maximum rating of 2,040 A when the Ottawa area load is 2,000 MW. Once again it is necessary to have available 400 MVAR of additional reactive power sources to maintain voltage under this contingency. Thus, the maximum Ottawa area load that could be supplied under the reduced security criterion is slightly above 2,000 MW.

The utility considers the voltage control in the Ottawa load area to be a significant problem. Under the outage conditions investigated there would have to be arrangements for the automatic switching in of reactive power sources immediately after the loss of transmission circuits.[1] As explained in Section VIII, this is

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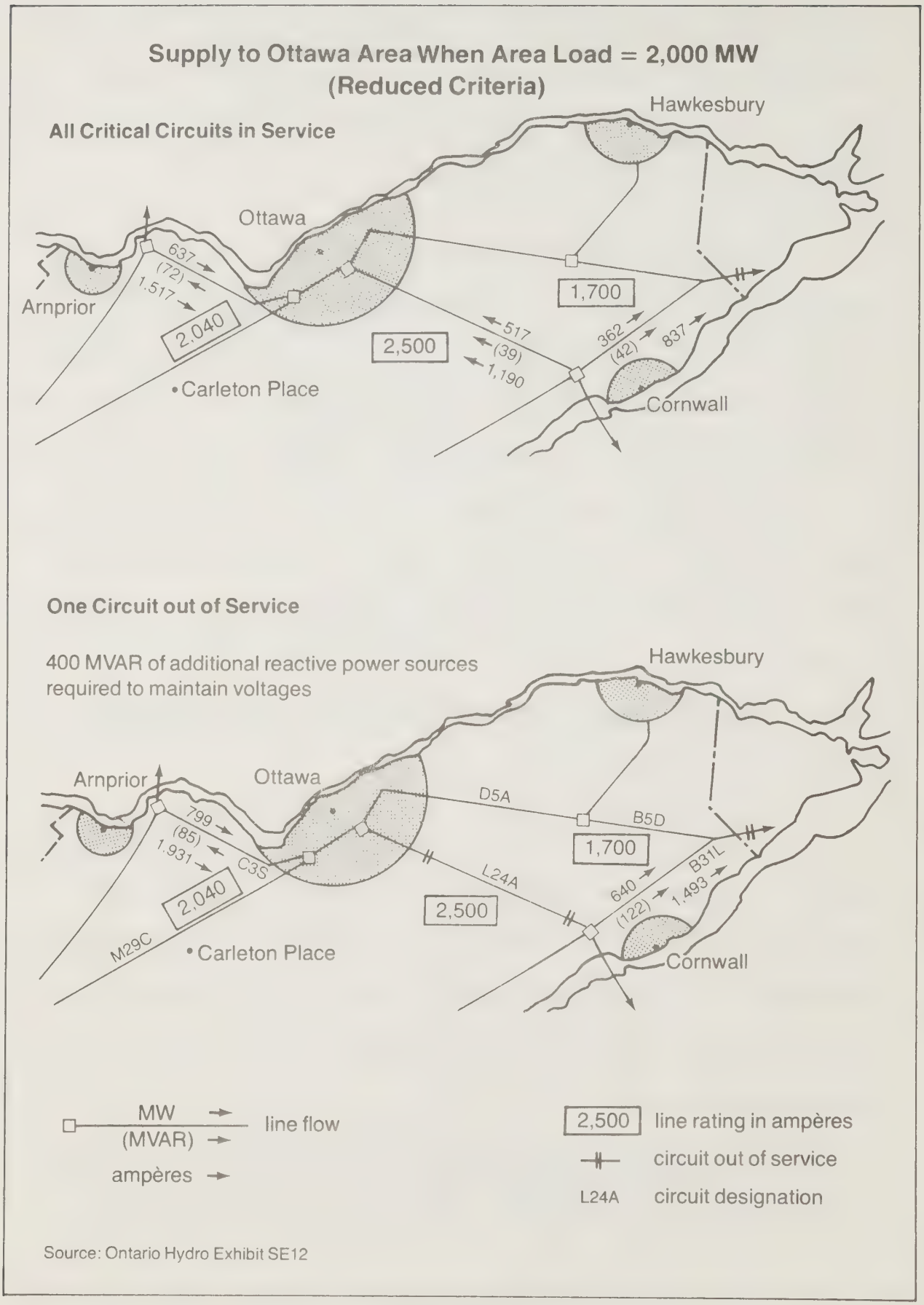
1. According to Ontario Hydro (SE3: App.1), the cheapest acceptable means of supplying the additional reactive power requirements is by providing shunt static capacitors at a cost of about $19 million (1979 dollars).



Source: Ontario Hydro Exhibit SE12

FIGURE 9.3

necessary because the action of the automatic tap-changing transformers would be insufficient to maintain acceptable voltage and could even lead to a voltage collapse.

Ontario Hydro pointed out that, whereas automatic switching of reactive power sources is not unknown in the industry, the extent of the installations planned ensured that the programme would be difficult and costly to accomplish from both the planning and the operational points of view. In order to determine the exact amount of switching of such sources for various load and operating conditions, many computer studies will have to be undertaken. As one Ontario Hydro witness pointed out, the number (and thus the cost) of these studies would probably be "a few hundred times" more than the number that would normally be required. Also, because of the nature of reactive power sources and their switching equipment, Ontario Hydro stated, relying on such arrangements to maintain supply to a load such as that in the Ottawa load area was imprudent, and this was being done only because there was no alternative:

> Capacitors by their very nature are not a reliable device, [not] as reliable say as tap changers or other mechanisms. They are prone to have trouble in both the breakers that switch them and you know we have had considerable problems, and capacitors themselves fail for various reasons. So that on paper you can set up a scheme that looks possible to operate, in the actual milieu you find that the circumstances are generally different than those that you...plan for. (T294:44180)

Lloyd Askwith, Manager of Ottawa Hydro, commented on his utility's experience:

> ...We have had five catastrophic failures since the advent of these capacitors. Each one has been coincident with, or very shortly following, the switching of large capacitor banks. We have been in consultation with Ontario Hydro about this. They feel sure that the voltage spikes which accompany such switching are not in themselves detrimental. We have an unpleasant feeling that the fact these capacitors are switched off and on on a daily basis, especially during the peak, has an accumulative effect that is not going to do our equipment any good.
>
> In case you wonder what a catastrophic failure is, it is a violent explosion. We have had one 5,000 kVA (kilovolt ampere) transformer explode - the tank burst...we have had cable terminations explode.... (T291:43789-90)

Ontario Hydro has conducted transmission studies to determine the extent of automatic capacitor switching required to prevent voltage collapse following the loss of transmission circuits at various load levels in the Ottawa load area. The results of these studies appear in Table 9.2. They show that, for the normal planning criterion (the loss of two elements), the load that can be supported without automatic capacitor switching is under 1,000 MW. It is necessary for the supply of loads above 1,000 MW to have increasing amounts of automatic capacitor switching, until, for loads of the maximum dictated by transmission-line ratings (1,300 MW), it is necessary to have full automatic switching to switch in precisely the correct amount of reactive power support. For the reduced criterion (loss of only one element) it was found that the maximum load that could be supplied without automatic capacitor switching is about 1,200 MW, and that the upper limit of load dictated by transmission

Table 9.2 Supply of Ottawa Area Load

Level of automatic capacitor switching	Ottawa Area Load (MW)*		
	None	Some	Full
Normal criterion (Loss of C3S and L24A)	<1,000	1,100	1,300
Reduced criterion (Loss of L24A)	1,200	1,500	2,000

*The numbers given are estimates. Determination of the exact amount of load supply for various levels of capacitor switching is expensive and time-consuming.

Source: Ontario Hydro Exhibit SE62

line rating could again only be achieved with full automatic switching of capacitors.

Ontario Hydro also noted that the switching in of excess amounts of reactive power would also have a bad effect, in that voltages would be raised automatically to excessive levels. Ontario Hydro stated that static compensators or synchronous condensers would provide better automatic reactive power support. These would, however, be extremely expensive.

Ontario Hydro's view as to the basic reason for the emergence of this voltage control and collapse problem in serving the Ottawa area load is that the critical circuits serving the load would be operating at load levels well in excess of those generally accepted by the electric utility industry as the maximum allowable for critical 230 kV transmission lines of such lengths (Fig. 9.4 and 9.5). As pointed out in Section VIII, the loading limits for shorter lines are based on the current-carrying capability. For lines of intermediate length, voltage control considerations may impose limits on power capability, whereas for long lines stability is the limiting factor. Fig. 9.4 shows that, when all the elements are in service, the critical circuits can supply an Ottawa area load of 1,300 MW and be within the loading limits. But with an overlapping outage of circuits L24A and C3S, the loading of circuit B31L-B5D-D5A exceeds the limit by almost 100 per cent. For an Ottawa area load of 2,000 MW, Fig. 9.5 shows that an outage of either circuit L24A or circuit C3S causes the loadings of the other two circuits to exceed the limit.

FIGURE 9.4

Circuit Capability and Loadings When Ottawa Area Load = 1,300 MW

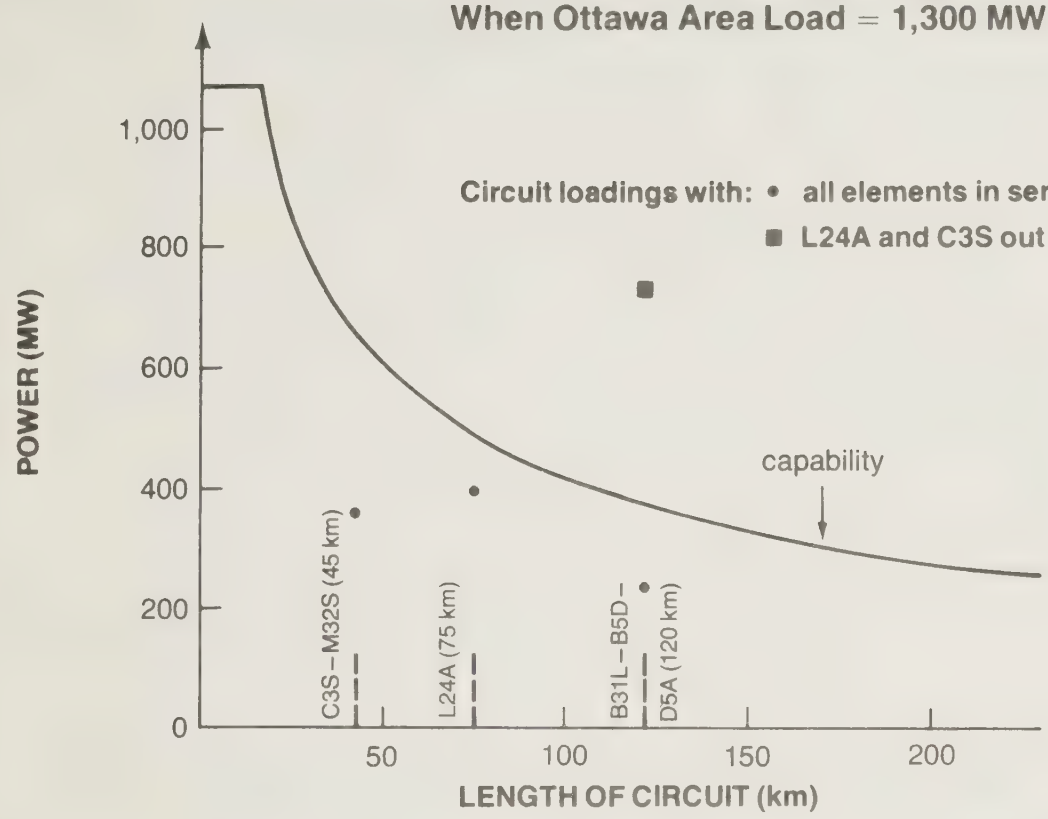
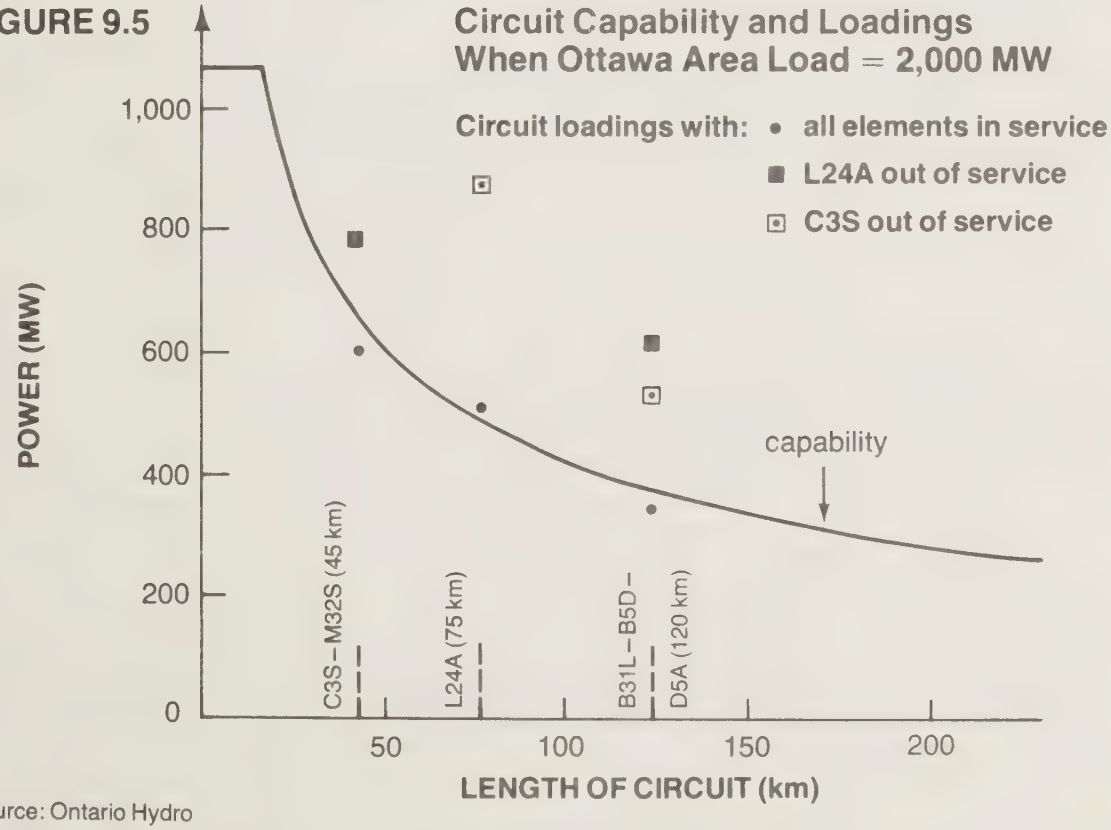


FIGURE 9.5

Circuit Capability and Loadings When Ottawa Area Load = 2,000 MW



Source: Ontario Hydro
Exhibit SE62

The Commission's Observations

The Commission takes the position that the security of power supply for the Ottawa area ought not to be below the level prevailing generally in the province. However, having carefully reviewed all the evidence before us, we have concluded that:

1. At this moment the security of supply to the Ottawa area is probably already less than that prevailing in most parts of the province. The uprating of critical transmission lines into the Ottawa area (via the so-called stop-gap measures) is still being done and is expected to be completed within a year or so. Because circuits may have to be taken out of service for considerable periods of time for such work, the security of supply during the course of uprating is going to remain inherently low.

2. The upgrading of transmission circuits, with heavier conductors, higher operating temperatures, and greater complexity of controls, inherently reduces their reliability.

3. Following full uprating of critical circuits, the level of load that could be supplied at the normal planning criterion (loss of two elements), without automatic switching of capacitors, has already been exceeded (Fig. 9.6). Fig. 9.6 also shows that the level of load (1,300 MW) that could be supplied with full automatic reactive power support would be exceeded in the early 1980s, with

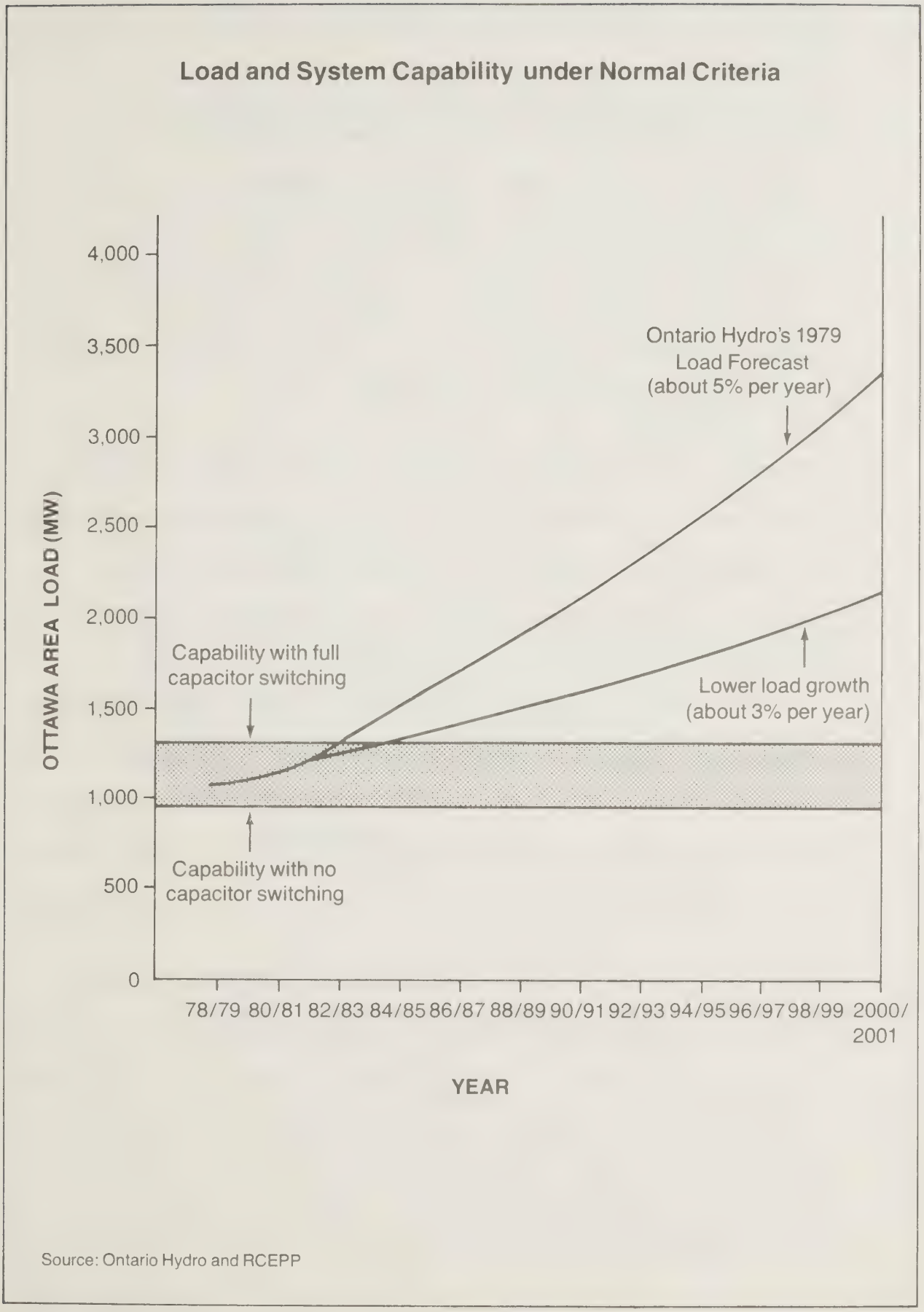

Load and System Capability under Normal Criteria
OTTAWA AREA LOAD (MW)
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Ontario Hydro's 1979
Load Forecast
(about 5% per year)
Capability with full
capacitor switching
Lower load growth
(about 3% per year)
Capability with no
capacitor switching
78/79 80/81 82/83 84/85 86/87 88/89 90/91 92/93 94/95 96/97 98/99 2000/
2001
YEAR
Source: Ontario Hydro and RCEPP

FIGURE 9.6

an average annual rate-of-load growth of anywhere from 3 to 5 per cent.

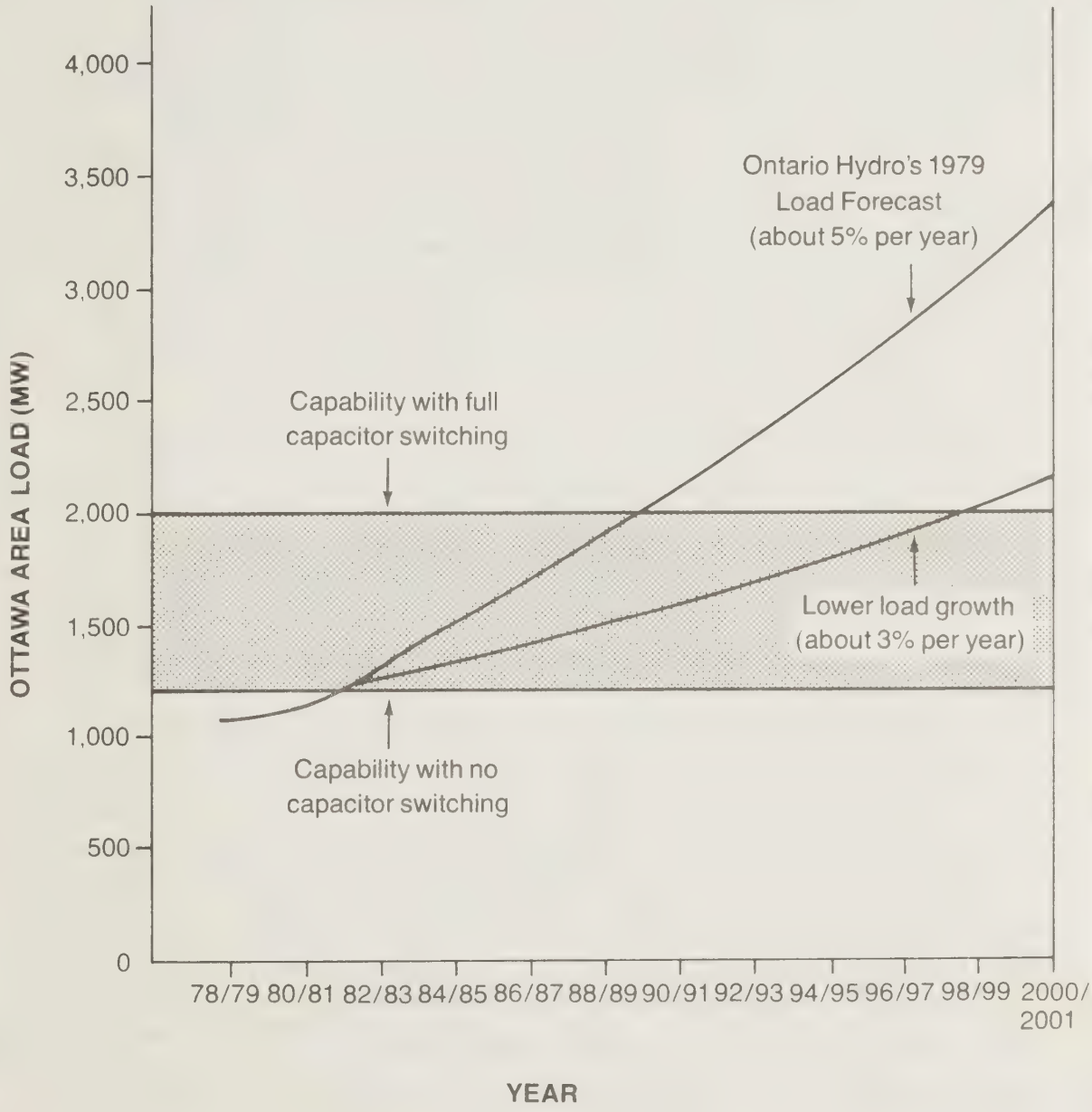
4. Since Ontario Hydro's evidence is that the earliest date by which major new bulk power transmission facilities could be installed to serve the Ottawa area is 1986, it is apparent that at any rate of load growth exceeding 3 per cent per annum the normal delivery capability of the system will be exceeded before new facilities can be provided.

5. With the reduced planning criterion (loss of only one element), some degree of automatic reactive power support would be required for loads above 1,200 MW that would occur by the winter of 1982-1983, even assuming a 3 per cent load growth (Fig. 9.7).

6. Under the reduced planning criterion and full capacitor switching about 2,000 MW of load could theoretically be supplied. However, maintaining supply with a system of automatic reactive power support at anywhere near the full switching level in the Ottawa load area would be imprudent. It should not form part of a normal system plan.

7. Without major new transmission facilities, incremental power losses in the bulk power system in eastern Ontario will increase rapidly. For example, a 920 MW growth in load will increase the losses by about 95 MW, that is, by a little over 10 per cent. This compares with a 2 to 3 per cent average loss in Ontario Hydro's total bulk power system. A 95 MW increase in losses is equivalent

Load and System Capability under Reduced Criteria



Source: Ontario Hydro and RCEPP

FIGURE 9.7

to the total output of the Chats Falls GS. Ontario Hydro's evidence was that by 1988 new transmission facilities could save as much as $18 million (in 1988 dollars) annually in energy losses avoided.

8. There are hydraulic stations upstream on the Ottawa River (Chenaux, Des Joachims and Otto Holden) and on the Madawaska (Mountain Chute) that are not directly connected to the Ottawa area load. It may at some stage be found desirable to utilize this generation to supply loads in the Ottawa area, but major new transmission facilities (though probably not 500 kV transmission) would be required to accomplish this. However, as this falls into the area of "solutions" to the limitations on the capability of supply to the Ottawa area, the Commission sought no evidence on the matter.

9. In the Commission's main hearings, Ontario Hydro identified a number of potential hydroelectric redevelopments and extensions for peaking and intermediate load applications. Of about 40 sites identified, 17 are considered to be relatively favourable for development in this century and were given general approval by the Ontario Hydro Board of Directors. However, the sites on the Ottawa River, including Chenaux and Chats Falls with a combined potential increase in peaking capability of about 240 MW, were not among the 17.

10. It is indicative of the seriousness of the supply situation to Ottawa that Ontario Hydro has installed a centrally controlled

system to shed up to about 300 MW of area load in order to avoid a voltage collapse under a transmission contingency, especially during the period of stop-gap work on critical circuits. Ontario Hydro admitted that if load shedding is repeated, the same customers would have to be shed each time, although if the requirement is less then 300 MW there could be some rotation of interruptions. We do not favour interruptions of firm supply to Ottawa-area customers, but note that the load-shedding scheme is in place and could be used to prevent voltage collapse in dire emergency.

11. A point made by Hydro counsel in final argument is worthy of mention. It is that, with respect to the Ottawa area problem, the best solution may involve removing one or more existing transmission lines entirely and replacing them in the same rights-of-way with lines of higher capacity. However, if existing circuits are allowed to approach their loading limits, it may be impossible to take any lines out of service while still maintaining the capacity to supply the load. In the end, an entirely new right-of-way might have to be found for the higher-capacity lines, resulting in greater disruption than would otherwise have been necessary.

In summary, the Commission considers that the reduction of the security of supply to the Ottawa load area, either by reducing the planning criteria or by using automatic reactive power support approaching full switching levels, is undesirable. Therefore, the Commission agrees that planning of additional facilities for supply to the Ottawa load area should proceed.

X - Interconnections with Neighbouring Systems

The study area contains the significant interconnection points between the Ontario and Quebec power systems, and one of the major interconnection points between Ontario and New York State. Fig. 6.1 shows the locations of these interconnections. In the Chats Falls and Ottawa areas there are interconnections with Quebec via two 230 kV circuits to Paugan, two 115 kV circuits to Val Tetreau, and two 115 kV circuits to Masson. Farther up the Ottawa River, there is a rather weak interconnection in the Chenaux-Bryson area. At the interprovincial boundary near Cornwall is the major interconnection with Quebec in the form of two 230 kV circuits (B31L and B5D) to Beauharnois. These circuits can be connected together to feed power from the Saunders Generating Station (GS) at Cornwall to the Ottawa area, or they can be disconnected from each other and used as connections between the Saunders GS and Beauharnois and between Beauharnois and Ottawa. From the Saunders GS there also are two 230 kV ties to the New York Power Pool system which form one of the major interconnections whereby Ontario Hydro's system is operated in synchronism with the large power grid covering much of eastern North America. The flow over these ties is controlled by special "phase-shifting" transformers. The joint capability of these ties has recently been increased to 600 MW (720 MVA).

During the Commission's hearings, special attention was given to the impact of these interconnections on the capability of the bulk power system to supply loads in the Ottawa area. In this section we will present Ontario Hydro's case and then make our own observations.

Ontario Hydro's Case

As explained in Section VIII, a major factor affecting the ties with Quebec is that, due to system stability problems, the Quebec power system cannot be connected synchronously with neighbouring power systems. The only means of accomplishing power transfers between Quebec and a neighbouring system is by isolating generation or load on one system and connecting it to the other system, or by the use of a direct-current link, as is the case between Quebec and New Brunswick. All transfers between Ontario and Quebec have to be performed by following the isolated load or generation procedure.

The interconnections between Ontario and Quebec (Fig. 6.1) in and north of the Ottawa area have, over the years, declined in usefulness. Their initial purpose was to transport power purchased from Quebec into the Ontario system, but growing load and weak transmission on the Quebec side of the border have virtually eliminated Quebec's ability to provide significant quantities of power in any but emergency situations. Before these ties could be of any significant use in the future, considerable strengthening of both the Ontario and Quebec transmission systems in the Ottawa area would have to be carried out. One of the interconnections, the two 115 kV circuits to Val Tetreau, is to be decommissioned after 1984 under an agreement between Hydro Quebec and the National Capital Commission. The Beauharnois ties which until June 1977 carried about 800 MW of the up to 1,187 MW that Ontario then purchased under contract from Quebec, can still perform a very valuable role in the transport of any available power

from Quebec to Ontario, since generation can be isolated from the Quebec system at the Beauharnois Generating Station and fed directly into the Ontario system (Fig. 9.1). Power taken at Beauharnois does not, however, improve materially the security of supply to the Ottawa area. Delivery to Ottawa would be via circuit B5D-D5A which, if it failed, would overload B31L-L24A.

Furthermore, the need to maintain security of supply to the Ottawa area precludes economic transfers of power from Ontario to Quebec. Transfers from Ontario to Quebec at Beauharnois can be accomplished only by opening the connection between circuits B31L and B5D, and then isolating some generation at the Saunders GS and connecting it to the Quebec system via B31L. About 400 MW can be transferred to Quebec in this manner, but, since the arrangement makes one of the critical circuits (B31L-B5D-D5A) feeding the Ottawa area load unavailable for that purpose, Ontario Hydro considers that it can do this only in conditions of severe emergency on the Quebec system.

Because the Ontario-Quebec ties are, for all practical purposes, only a one-way interconnection (Quebec to Ontario), Ontario Hydro considers that valuable opportunities for economic interchange and mutual support between the two systems are being foregone. There has been considerable discussion between Ontario Hydro and Hydro Quebec concerning the construction of a high-voltage direct-current link between the two systems for this mutual support and economic interchange, but before such an interconnection materializes, considerable strengthening of the Ontario Hydro system in

eastern Ontario would be required. As stated in Section IX, Hydro Quebec, at this time, is not offering any firm power for sale to Ontario. Any imports from New York into eastern Ontario via the interconnection at Cornwall do not facilitate supply to the Ottawa load area due to the limitations on the capability of the circuits between the Saunders GS and Ottawa.

On the issue of exports to New York, Ontario Hydro provided evidence to show that the growing load in the Ottawa area will eventually restrict the amount of power that can be transferred from Ontario Hydro to the New York Power Pool at Cornwall. Because the Saunders GS is a run-of-river plant normally operated at full capability, the increased generation to support an export at Cornwall has to come from generating stations west of the study-area boundary. The additional flow of power is divided among all the possible circuit paths, including those along the Chats Falls-Ottawa-Cornwall route. Thus, for an export of, say, 100 MW to New York at Cornwall, there is an increase in the loading of circuit C3S-M32S of about 22 MW and at the same time a reduction in the loadings of L24A and B31L-B5D-D5A (Fig. 9.1).

Under the reduced criterion, (loss of one major element) for the supply of the Ottawa area load as discussed in Section IX, Ontario Hydro showed that, for a load of 2,000 MW in the Ottawa area, the loading on the Chats Falls-to-Ottawa circuit (C3S) is very close to its rating following the loss of circuit L24A (Fig. 9.3). With a 600 MW export to New York at Cornwall (the rating of the interconnection), the change in system power flows

would result in the loading of C3S reaching its rating for an Ottawa area load of only 1,850 MW (following the loss of L24A). Since in all but the most exceptional circumstances firm loads in Ontario take precedence over exports, this implies that, once the Ottawa area load has reached about 1,850 MW, the capability to export to New York at Cornwall will start declining and that it will be zero by the time the Ottawa area load has grown to about 2,000 MW, unless major new bulk power facilities are installed in eastern Ontario. Under Ontario Hydro's current load forecast, its export capability at Cornwall begins to deteriorate significantly in the winter of 1988-9.

The Commission's Observations

1. With regard to the Ontario-Quebec interconnections, the Commission views the present situation with concern and agrees with Ontario Hydro that the poor capabilities of these interconnections is probably a major factor acting against mutually beneficial interchanges of power and energy. Ontario's electrical power system is becoming increasingly thermal (63 per cent of the electrical energy generated by Ontario Hydro in 1978 came from thermal sources) while Quebec's system is predominantly hydraulic and is expected to remain so to the end of this century. The Commission considers that suitable interconnection between these two large systems with their very different basic resources would prove beneficial to both systems, from the standpoint of economy of operation as well as from the standpoint of their ability to deal with system emergencies.

2. The Commission notes that Ontario Hydro and Hydro Quebec are considering establishing a substantial interchange capability in the form of a back-to-back direct-current link rated at about 1,000 MW initially and growing to 2,000 MW in time. A similar station rated at 320 MW is already in place between Quebec and New Brunswick. The results of a study being undertaken by Ontario Hydro in this regard are expected soon.

3. In addition to bilateral initiatives between the utilities directly concerned, other forums are currently giving close attention to

interconnections within Canada. The Inter-Provincial Advisory Council on Energy (IPACE), which comprises the Provincial Deputy Ministers of Energy, recently sponsored a study of strengthened inter-provincial interconnections. That study was generally supportive of increased interprovincial electricity trade, in general, and of the proposed Ontario-Quebec link, in particular.

4. With regard to the ties with New York State at Cornwall, the Commission recognizes that restrictions in export capability at this point would compound other export limitations at the Windsor-Sarnia interconnection points noted during the southwest Ontario hearings. Such limitations would certainly restrict profitable transactions and could ultimately reduce the level of willingness to provide mutual support that now exists between Ontario Hydro and its southern neighbours.[1]

5. The Commission also recognizes that Canada and the United States have recently issued a joint report on electricity exchanges between the two nations which records that "the United States and Canada have resolved to explore the potential benefits of increased international electricity transactions and have identified recommendations which can be acted upon by the governments and operating electric utilities".

6. The Commission endorses both the IPACE and joint U.S./Canadian initiatives and will have more to say on this vital matter in its Final Report.

Note

1. The net revenue from export sales of electricity in 1979 is estimated by Ontario Hydro to be in the neighbourhood of $150 million. The net revenue over the last three years (1976-78) was $245 million.

A P P E N D I C E S

Ontario

Executive Council

O.C. 2065/78

APPENDIX A

Copy of an Order-in-Council approved by Her Honour the Lieutenant Governor, dated the 12th day of July, A.D. 1978.

The Committee of Council have had under consideration the report of the Honourable the Provincial Secretary for Resources Development, wherein he states that,

WHEREAS the Royal Commission on Electric Power Planning was appointed pursuant to The Public Inquiries Act, 1971, and its terms of reference were established by Order-in-Council numbered OC-2005B/75 dated 17th July, 1975;

AND WHEREAS paragraph 4 of Order-in-Council numbered OC-2005B/75 called for the Commission to consider and report on certain projects on a priority basis;

AND WHEREAS by Order-in-Council numbered OC-3489/77 the Royal Commission on Electric Power Planning was requested to provide its interim report on issues relating to nuclear power in Ontario by June 30, 1978;

AND WHEREAS since July, 1975, revisions have been made in the projections of electric load growth expected to occur in Ontario Hydro's East System before 1988, and beyond that date to the year 2000;

AND WHEREAS, in part as the result of such load growth revisions for the period beyond 1987, it is no longer necessary for the Royal Commission to

consider and report on a priority basis on the North Channel generating station;

AND WHEREAS in light of the passage of The Environmental Assessment Act, 1975, which followed the approval of the Royal Commission's terms of reference, the description of specific transmission connections set out in paragraph 4 of the terms of reference is no longer appropriate and should be replaced by an examination of the need for, and the timing of, additional bulk power facilities within broad geographic areas;

AND WHEREAS it is desirable to have the Royal Commission on Electric Power Planning review the need for, and the timing of, additional bulk power facilities and to report thereon to the Ministry of Energy, and for the specific nature of additional bulk power facilities which might then be proposed, including their locational and environmental aspects, to be reviewed by the Environmental Assessment Board;

AND WHEREAS the Government further intends to appoint members of the Royal Commission on Electric Power Planning to the Environmental Assessment Board in order to transfer experience in electric power planning matters to that Board;

AND WHEREAS by Order-in-Council numbered OC-1999/78 dated the 5th day of July, 1978, the Committee of Council amended paragraph 4 of the Commission's terms of reference,

AND WHEREAS a paragraph was omitted from Order-in-Council numbered OC-1999/78, rendering it incomplete,

The Honourable the Provincial Secretary for Resources Development recommends that Order-in-Council numbered OC-1999/78 be revoked and that paragraph 4 of Order-in-Council numbered OC-2005B/75 be further amended as follows:

4.) A) Having concluded its hearings with respect to paragraphs 1, 2 and 3 of its terms of reference;

i) For the geographic area of Ontario south of Bruce nuclear power development and west of a line between Essa transformer station and Nanticoke generating station, consider and report to the Minister of Energy on or before May 31, 1979 on load growth in the area up to the end of 1987 and from 1987 to the year 2000, the capability of existing and committed bulk power generation and transmission facilities to supply this load to the area taking into account Government policy with respect to the use of interconnections with neighbouring utilities, and the resulting date at which additional bulk power facilities, if any, will be needed, but excluding consideration of the specific nature of the additional bulk power facilities which may be required and of their locational and environmental aspects; and

ii) For the geographic area of Ontario east of Lennox generating station, consider and report to the Minister of Energy on or before June 30, 1979 on load growth in the area up to the end of 1987 and from 1987 to the year 2000, the capability of existing and committed bulk power generation and transmission facilities to supply this load to the area taking into account Government policy with respect to the use of interconnections with neighbouring utilities, and the resulting date at which additional bulk power facilities, if any, will be needed, but excluding consideration of the specific nature of the additional bulk power facilities which may be required and of their locational and environmental aspects;

B) Provide the Government with its report and recommendations on paragraphs 1, 2 and 3 of these terms of reference on or before October 31, 1979.

The Committee of Council concur in the

recommendation of the Honourable the Provincial Secretary for Resources Development and advise that the same be acted on.

Certified,

Deputy Clerk, Executive Council.

TERMS OF REFERENCE

The Royal Commission on Electric Power Planning has been empowered and instructed under Order-in-Council number 2005B/75 dated the 17th day of July, A.D. 1975 to:

1) Examine the long-range electric power planning concepts of Ontario Hydro for the period of 1983-93 and beyond and to report its findings and recommendations to the Government, so that an approved framework can be decided upon for Ontario Hydro in planning and implementing the electrical power system in the best interests of the people of Ontario;

2) Inquire comprehensively into Ontario Hydro's long-range planning program in its relation to provincial planning; to domestic, commercial and industrial utilization of electrical energy; to environmental, energy and socio-economic factors, including load growth, systems reliability, management of heat discharged from generating stations, interconnecting and power pooling with neighbouring utilities, export policy, economic investment policy, land use, general principles on the siting of generating utilization of electrical energy and wise management (conservation) of primary energy resources, power generation technology, security of fuel supplies and operational considerations;

3) Deal primarily with the broader issues relating to electric power planning, and thus serve to alleviate the need for re-examination of these issues at subsequent hearings of other hearing bodies on specific details such as siting, rates, etc.;

4) Consider and report on a priority basis on the need for a North Channel Generating Station, a second 500 k.V. line from Bruce, a 500 k.V. supply to Kitchener, a 500 k.V. line from Nanticoke to London, and a 500 k.V. line in the Ottawa-Cornwall area, and other projects as may be directed by the Lieutenant Governor in Council.

Paragraph 4 was amended and supplemented under O.C.3489/77 dated the 14th day of December, A.D. 1977 to include that the Royal Commission on Electric Power Planning be instructed and empowered to complete its examination of issues relating to nuclear power, to prepare an interim report of its opinions and conclusions in this area, including the extent of the need for nuclear as a component of Ontario's future energy supply and the proportion of nuclear power in Ontario Hydro's future generating capacity, and to provide such report on or before the 30th day of June, A.D. 1978.

Paragraph 4 was further amended under Order-in-Council number 2065/78 dated the 12th day of July, A.D. 1978, as follows:

A) Having concluded its hearings with respect to paragraphs 1, 2, and 3 of its terms of reference;

i) For the geographic area of Ontario south of Bruce Nuclear power development and west of a line between Essa transformer stations and Nanticoke generating station, consider and report to the Minister of Energy on or before May 31, 1979 on load growth in the area up to the end of 1987 and from 1987 to the year 2000, the capability of existing and committed bulk power generation and transmission facilities to supply this load to the area taking into account Government policy with respect to the use of interconnections with neighbouring utilities, and the resulting date at which additional bulk power facilities, if any, will be needed, but excluding consideration of the specific nature of the additional bulk power facilities which may be required and of their locational and environmental aspects; and

ii) For the geographic area of Ontario east of Lennox generating station, consider and report to the Minister of Energy on or before June 30, 1979 on load growth in the area up to the end of 1987 and from 1987 to the year 2000, the capability of existing and committed bulk power generation and transmission facilities to supply this load to the area taking into account Government policy with respect to the use of interconnections with neighbouring utilities, and the resulting date at which additional bulk power facilities, if any, will be needed, but excluding consideration of the specific nature of the additional bulk power facilities which may be required and of their locational and environmental aspects;

B) Provide the Government with its report and recommendations on paragraphs 1, 2, and 3 of these terms of reference on or before October 31, 1979.

Ontario

Office of the Chairman

Royal Commission on Electric Power Planning

416/965-2111

7th Floor
14 Carlton Street
Toronto Ontario
M5B 1K5

ROYAL COMMISSION ON ELECTRIC POWER PLANNING

REGIONAL HEARINGS TO CONSIDER BULK POWER FACILITIES IN EASTERN ONTARIO

Chairman's Opening Statement

Because concern has been expressed relating to the need for these hearings, in view of recent announcements concerning Ontario Hydro's excess generating capacity, it is appropriate that the first session of these hearings should be opened with a statement that I hope will put the purpose and value of the hearings into adequate perspective.

Let me begin by quoting the appropriate portion of Paragraph 4 of our Terms of Reference as amended under Order-in-Council dated 12 July 1978:

> "ii) For the geographic area of Ontario east of Lennox generating station, consider and report to the Minister of Energy on or before June 30, 1979 on load growth in the area up to the end of 1987 and from 1987 to the year 2000, the capability of existing the committed bulk power generation and transmission facilities to supply this load to the area taking into account Government policy with respect to the use of interconnections with neighbouring utilities, and the resulting date at which additional bulk power facilities, if any, will be needed, but excluding consideration of the specific nature of the additional bulk power facilities which may be required and of their locational and environmental aspects;"

... 2

In consequence of the above Ontario Hydro prepared a detailed analysis of the potential load growth in the area, and the capability of existing facilities to meet this growth. On October 25, 1978 we wrote to Ontario Hydro expressing our hope that this report would include in-depth information on several factors that, in our view, would be important determinants of the electrical load growth in the Eastern Ontario region, as follows:

- population growth
- housing starts
- electrical energy needs of industry and agriculture, especially new industries
- additional electrical energy needs of the commercial sector.

We received Ontario Hydro's submission - "Requirement for Additional Bulk Power Facilities to supply Eastern Ontario" on January 11, 1979. Copies of this document were distributed widely to municipalities, local hydro offices and special interest groups during February 1979.

During the period January 15 - 26, 1979 the submission was studied in depth by the Commission and staff and we concluded that the information supplied by Ontario Hydro was inadequate for our purposes in some respects and needed further clarification in others. These views were fully endorsed by several outside consultants. In consequence, a comprehensive set of questions was developed by the Commission and these were transmitted to Ontario Hydro. We received the answers to these questions in the form of a document "Bulk Power Facilities Eastern Ontario - Supplementary Information" on March 22, 1979. This report, as well, was widely circulated throughout the Eastern Ontario region. Both the main submission and the supplementary information will be filed as exhibits - they are available at the entrance.

Although the replies to the majority of the questions we submitted assist in clarifying the original Ontario Hydro submission, the reply to what the Commission regards as the central question is not satisfactory. I refer to the question at the top of page 1 of the "Supplementary Information Document":

"Does Ontario Hydro's load forecasting process use estimates of various factors such as population growth rates, growth in households (including type of housing and heating), commercial manufacturing and industrial growth and the related uses of electricity, and technological change in the use of electricity in order to forecast electrical growth ? If so, could such estimates be provided."

In response, and I refer again to page 1 of the document, Ontario Hydro replied:

"Estimates of such factors, and their relationship to electrical growth, represent the type of information which is useful when an end-use or explanatory approach is being used in forecasting. This has not been the approach taken by Ontario Hydro, with the result that the data gathered for Ontario Hydro's load forecasting is not of this type and has not been organized in this way. However, the load forecasting methodology used by Ontario Hydro does rely heavily on estimates of local load growth provided by Hydro's wholesale customers (the municipal utilities), by direct industrial customers and by Ontario Hydro's regional offices (for retail areas serviced directly by Ontario Hydro). Embedded in these estimates are judgements based on first-hand knowledge of the demand for electricity and local activities, factors or trends which will change these demands. During its participation in the regional hearings, it is intended that Ontario Hydro's regional personnel will be presenting, for discussion with the Commission, the local information which appears most pertinent to load growth in certain key areas in Eastern Ontario."

It will be noted that while Ontario Hydro intends to present some of the detailed information requested by the Commission during these regional hearings, through the utilities' regional personnel supplemented, we understand, by the staff of the local public utility

commissions, this information has not been available to the intervenors for detailed study prior to the hearings. However, the Commission, as a result of the Southwest Ontario hearings, has obtained a general idea of the nature of this information and how it is used.

Prior to the Southwest Ontario public hearings, which were concluded on March 28, 1979, the Commission considered the possibility of postponing the hearings sine die until much more detailed information had been provided by Ontario Hydro. Indeed, the 'pros' and 'cons' of proceeding as scheduled or postponing the hearings were in fact set out in the Chairman's Opening Statement which was read into the record at the London hearing held on March 6th. However, in spite of our original concern relating to the inadequacy of the information base, we were conscious of the importance of providing every possible opportunity for the people in the Southwest Ontario region to express their views on electricity load growth, and on the adequacy of bulk power facilities now and in the future.

In general, the same argument for proceeding with the Eastern Ontario regional hearings, as planned, applies. In particular, we are aware that many individuals, groups and organizations have spent a great deal of time preparing submissions and preparing for the cross-examination of Ontario Hydro panels. Accordingly, we believe it would not be in the best interests of the people of Eastern Ontario and indeed of the province as a whole, to delay unduly these hearings. We are, of course, profoundly committed to public participation.

Because it has been intimated, during the Southwest Ontario regional hearings that ambiguities exist in the terms of reference with respect to these hearings, especially insofar as related hearings convened under the Environmental Assessment Act are concerned, it may not be out of place to comment on this question. In fact, during the Southwest Ontario regional hearings, I stated that the Commission had some reservations because of these potential ambiguities.

Nevertheless, although I personally was not involved in the drafting of the amended paragraph 4 of our terms of reference, I take full responsibility for accepting them as the basis for these hearings. But I would be less than frank if I did not reveal, after four arduous

years of studying the highly complex concepts that underpin electric power planning that I am more than ever convinced that the Eastern region of Ontario, highly significant though it is, must be considered in the light of the total system.

Only after the Final Report of the Commission has been completed will the problems being addressed today be put into a proper perspective.

APPENDIX C

OPENING REMARKS MADE BY MR. BRUCE CAMPBELL, COUNSEL TO ONTARIO HYDRO, FOLLOWING THE CHAIRMAN'S OPENING STATEMENT AT THE COMMENCEMENT OF THE EASTERN ONTARIO HEARINGS ON APRIL 9, 1979

At the beginning of the Chairman's statement, reference was made to the size of the generation margins on the Ontario Hydro system. Ontario Hydro does, as everyone is aware, have the capability to generate more electricity than is actually required today. And it will have this capability for several years.

It can be no secret, however, that Hydro feels that the existing and committed transmission portion of the total system is becoming inadequate. I cannot emphasize too strongly that it is the total electric power system which Hydro's customers rely on the meet their electrical requirements.

In addition, it is important to recognize that these hearings could not result in a decision to commit and build additional facilities. That decision could not be taken for some considerable time.

If the Commission finds a need for additional facilities, the practical effect will be to allow a planning and review process to commence so that, if the need is still apparent, the option of adding facilities in a timely way is not foreclosed.

The question of what process might follow these hearings was raised during the Southwestern Ontario hearings, and may be of general interest to those attending these hearings.

Assuming that the Royal Commission concludes that existing and committed facilities will become inadequate, and as a first step following the issuance at the end of June of the Royal Commission's report arising from the Eastern Ontario hearings, Ontario Hydro would prepare and submit under The Environmental Assessment Act a system and broad band environmental assessment. This would outline and evaluate alternative system arrangements and alternative broad bands for the location of those system alternatives. When submitting the document, Ontario Hydro would request a hearing under The Environmental Assessment Act. Ontario Hydro is hopeful that the environmental assessment hearing procedures will encourage a useful dialogue on all relevant issues.

I would also like to address the Chairman's remarks regarding the adequacy of the information provided.

Referring to the first question in the Supplementary Information Document, as stated in that document Ontario Hydro did provide population projections for the study area, broken down by age group, sex and county. I had understood from the Commission's staff that these breakdowns were in greater detail than they had been able to obtain and, indeed, some thanks was expressed to Ontario Hydro for this.

I should also point out that Ontario Hydro has made available to the Commission's staff a list of all of the data accumulated in Ontario Hydro's Rates and Utilization Branch with respect to electricity usage. This is undoubtedly the best single collection of data in Canada on electricity usage.

The listing was created in order to be able to better identify additional data requirements as Ontario Hydro continues to develop predictive models which use forecasts of the type of determinants mentioned in order to build an overall forecast. Again, the Commission's staff indicated that the listing and the information accessible through it would be very helpful.

At the time, therefore, of the preparation of the Supplementary Information Document, when the data which was available was reviewed with the Commission, I also advised the Commission that certain of its questions about some of those determinants could not be answered with sufficient confidence to make the answers helpful. In short, Ontario Hydro was not prepared to develop and put forward projections of individual end uses in which it did not have confidence and which it felt would be misleading. Nor, I am sure, would the Commission have wanted Ontario Hydro to do so.

Ontario Hydro does feel, however, that the load forecasting process used by it does capture the effects of all major determinants and that it provides high quality operational forecasts well suited to Ontario Hydro's needs.

Both the Select Committee and the Ontario Energy Board have felt themselves capable of fairly and, if I may add, favourably assessing both the forecasting process and the forecasts produced. I see no lack of capability in the Commission which would prevent it from carrying out the same task.

The Commission has been advised that Ontario Hydro is developing Regional econometric models to supplement its present load forecasting process. In addition, Hydro hopes that the Stanford Research Institute model referred to in the submission and the Ministry of Energy model will assist in load forecasting once experience has been gained in their use.

The Ministry of Energy model has received a good deal of attention recently, so I would like to mention it specifically. It has been under development for four years, and Mr. Rowan, the Deputy Minister of Energy, recently testified before the Select Committee that "I am not suggesting it is complete. It is in its early stage".

The Ministry of Energy staff has also testified that the growth rates for electricity arising out of the model should not be used as a load forecast. I think in this regard, it is important

COMPARISON OF FORECAST LEVELS

		Ontario Hydro Forecast 790212					Ministry of Energy		
		Mw-Yrs	BTUx10^{12}	Ontario Hydro Sales (1)	Other (2)	Final Sales (3)	Final Sales	Self. Gen. (5)	Total
1975 Act.	(4)	9,614	287.4	261.3	13.6	274.9	274.2	12.3	286.5
1980		11,603	346.6	315.3	14.3	329.6	328.2	15.1	343.3
1985	(4)	14,493	433.2	393.7	15.0	408.7	392.6	18.9	411.5
1990		18,363	548.6	498.7	15.8	514.5	439.1	20.6	459.7
1995		22,853	683.0	620.6	16.6	637.2	491.1	22.4	513.5
2000	(4)	27,805	831.0	755.0	17.4	772.4	546.3	27.3	573.6
		(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)

(1) Allows 9.2% for losses +0.3 BTUx10^{12} Ontario Secondary Sales.

(2) Assume to grow at 1%. 1975 value estimated by subtraction Ontario Hydro from (3).

(3) Per "Detailed Energy Supply and Demand 1975" Statistics Canada 57-207

(4) Ministry of Energy's Forecast provided for years indicated. Other years interpolated geometrically. This means an abrupt change in growth in 1986.

(5) Generated for own use by industry.

Note: Comparable figures are shown in cols. (v) and (vi).

Utilization Forecasting
Revised March 9, 1979

APPENDIX D

EASTERN ONTARIO HEARINGS - PARTICIPANTS AND REPRESENTATIVES

Participant	Representative
CORNWALL April 9, 1979	
North County Defence Committee	Margaret Weitzmann Joel Ray Clyde Morse
Dominion Textile Inc.	Bernard Hamel
Canadian Industries Ltd. - Cornwall	Roy Rumple
United Counties of Glengarry, Stormont and Dundas	Larry Cotton
Ministry of Natural Resources	Jeff Higman
SMITHS FALLS April 11, 1979	
Thyme & Sage Machinery Ltd.	Paul Neelands
Ontario Non-Nuclear Network	Gary Glover
Ministry of Natural Resources	A.S. Corlett
Tosn of Smiths Falls Economic Development Commission	Lucien Lalonde
Smiths Falls Chamber of Commerce	Rosslyn Hill
Township of South Sherbrooke	Stuart Munroe, Reeve
KINGSTON April 17, 1979	
School of Urban & Regional Planning, Queen's University	Professor Gerald Hodge
Kingston Public Utilities Commission	Dr. R.H. Hay
Alcan Canada Products Limited	Jim Latimer
Cataraqui, Frontenac and St. Lawrence Wards Ratepayers' Association	Mrs. Irene Mooney

Participant	Representative
Helen Henrickson	
Department of Physical Plant Queen's Unviersity	Jerry MacCahill
Millhaven Fibres Limited	William Campbell
Mark Bunting Michael C. Turcot	
Kingston Coalition for Nuclear Responsibility	S.L. Segel
PRESCOTT April 19, 1979	
South Grenville District High School	Mildred Chang Cheryl Dutecky Laura Graham Donna Fox
People Against Nuclear Development Anywhere	Bill Borger Peter Onstein Emily Finn Sally Schmidt
Town of Prescott	Mayor Sandra Lawn Peter Martin
Prescott Public Utilities Commission	Foch Healey
Genstar Chemical Limited	Ted Bjerkelund
Grenville County Federation of Agriculture	Richard Dennison
Blue Church Area and Augusta Township Council	William Keith
The Dundas County Federation of Agriculture	Anna Smail John Dalrympk Ross Dulmidge
Clean Land Air & Water	William Bartlett Winifred Veich Barbara Doe

Participant	Representative
OTTAWA April 23, 1979	
Carleton East	Evelyn Gigantes, MPP
Department of National Defence	J.V. Johnson
City of Ottawa	Controller Ralph Sutherland
Marey Gregory	
Gloucester Hydro	Arthur J. Bowker
OTTAWA April 24, 1979	
Ottawa Board of Trade/Commercial and Industrial Development Corporation of Ottawa	Spencer Ballantyne George Perley
Association of Major Power Consumers in Ontario	Alex Munroe
R.L. Crain Ltd.	John Holowka
Ottawa Hydro	Mr. L. Askwith
The Housing and Urban Development Association of Canada - Ottawa	Mr. John Russell
IVACO Rolling Mills and Eastern Steelcasting	John Griffiths Gordon Silverman David Goldsmith
University of Ottawa	E. Butterworth
The Hydro-Electric Commission of the City of Nepean	Wayne Phillips
Michael Bein Milt Maybee	
OTTAWA April 25, 1979	
United Counties of Prescott and Russell	Phillip McNeeley M. Laframboise John Kirby
Ottawa Health Science Centre	W. Flude

Participant	Representative
Ottawa Civic Hospital	R. Stuart Haslett
Consumers' Gas Company	R.H. Townsend
National and Provincial Parks Association	C.W. Woodley
ARNPRIOR April 26, 1979	
Badische Canada Limited	L. A. Marshall
Huyck Canada Ltd.	C.G. Hill
North Lanark Energy Conservation Centre	Earl Hansen
Town of Renfrew	Mr. R. Thomson
Arnprior Business Association	Ben Sauve
Northern Municipalities of Almonte, Ramsay and Pakenham	Harold Swierenga
City of Kanata	Mayor Marianne Wilkinson
Dr. W.E. Gordon	
Milt Maybee	
WRITTEN SUBMISSIONS ONLY	
Association of Concerned Ratepayers, Prescott	
Building Owners & Managers' Association, Ottawa	
Playtex Ltd., Arnprior	

THE DEVELOPMENT OF THE BULK POWER SYSTEM IN EASTERN ONTARIO

CHRONOLOGY OF MAJOR EVENTS

1906, May 6	Passage of "Hydro Bill" in Ontario Legislature
1907	First contract placed for purchase of power from Ottawa and Hull Power Manufacturing Company for resale to Ottawa for its recently purchased distribution system.
1913	Eastern (or St. Lawrence) System operated by H.E.P.C. extends from Morrisburg to Prescott and north to Winchester. Power purchased from Rapids Power Company at Morrisburg.
1915	Brockville added to the St. Lawrence System.
1916, March 1	Electric Power Company generating stations, transmission lines and distributing stations purchased by Provincial Government.
June 1	H.E.P.C. commences operation of the facilities of the Electric Power Company and its subsidiaries at the Central Ontario System.
1917-18	Supply to numerous towns in Eastern Ontario commenced by H.E.P.C. through the St. Lawrence, Ottawa and Rideau systems, including Chesterville, Almonte, Carleton Place, Kemptville, Lanark, Merrickville, Perth and Smiths Falls.
1925	Rideau and St. Lawrence Systems still operating separately.
1926, May 19	Initial Quebec contract signed for supply from Gatineau Power Co. at 25 Hz.
1927, Dec. 28	60 Hz contract with Gatineau Power Co. for supply to Eastern Ontario.
1927	Construction started on first 230 kV transmission lines from Paugan Falls (Gatineau) to Leaside.
1928, Oct. 1	First Gatineau line in service.
Oct. 31	Leaside TS placed in service, receiving Gatineau power over the new 230 kV lines.

Ontario

APPENDIX F

Royal Commission
on Electric Power
Planning

416/965-2111

7th Floor
14 Carlton Street
Toronto Ontario
M5B 1K5

January 4th, 1979

Mr. Malcolm Rowan
Deputy Minister
Ministry of Energy
Queen's Park
Toronto, Ontario

Dear Mr. Rowan:

Order-in-Council No. 2065/78, dated the 12th of July, 1978, requires the Commission, in Paragraphs 4(A)(i) and (ii), to consider and report on the load growth and the capability of existing and committed bulk power generation and transmission facilities to supply this load to the east and west areas, and the Commission is currently planning to complete the hearings with respect to these studies in March and April.

It is noted that the Order-in-Council requires the Commission to take "into account government policy with respect to the use of inter-connections with neighboring utilities".

In order, therefore, that the Commission may have a clear understanding of government policy with respect to the use of inter-connections with neighboring utilities, it would be appreciated if the Commission could receive, through you, a statement of this policy so that there would be no misunderstanding with respect thereto, and that the Commission would have a clear understanding of that which they must take into account in carrying out the requirements of the Order-in-Council.

Yours very truly,

FRH/mta

Frederick R. Hume Q.C.
Commission Counsel.

Ontario

Office of the
Deputy Minister

Ministry of
Energy

Telex
Enrgy Tor
06-217-880

Queen's Park
Toronto Ontario

February 27, 1979

Frederick R. Hume, Q.C. Esq.
Commission Counsel
Royal Commission on
Electric Power Planning
7th Floor,
14 Carlton Street
Toronto, Ontario
M5B 1K5

Dear Mr. Hume:

In response to your request of January 4, 1979 for a statement of government policy with respect to the use of interconnections with neighbouring utilities, I should state that this policy encompasses:

1) support for the fullest use, as technically and economically justified, to be made by Ontario Hydro of its power system's existing interconnections with neighbouring utilities in Canada and the United States.

   The above policy is reflected in the government's acceptance of recommendation III-21 in the June 1976 report by the Select Committee inquiring into Hydro's proposed Bulk Power Rates. A copy of the government's response is attached.

2) support for the strengthening, as technically and economically justified, of Ontario Hydro's power system interconnections with neighbouring utilities in Canada and the United States, so that increased use of them in the future will be possible, for all forms of interchange of power, including firm power contracts, as approved by the government.

..2/

The Government has requested Ontario Hydro to explore the possibility of marketing surplus power, on either an interruptible or a firm basis, to other Canadian and American utilities, consistent with the needs of and benefits to Ontario power consumers. Interconnections and associated transmission within Ontario must be accorded a high priority in successfully marketing surplus power. Extracts from the statement made by the Minister of Energy to the Legislature on April 17, 1978, concerning Ontario Hydro's construction program 1978-1987, are enclosed. I should also refer you to the Hansard record of the Minister's statements before the Select Committee on Hydro Affairs on August 16, 1978, a copy of which will be in your Commission's library.

I should add that the Government, ever since 1973, has expressed support for achieving greater utilization of Canada's power generation resources through regional power grids. This support is evident from the positions taken by the Government of Ontario at First Ministers' Conferences (1974 to date), as well as from the support given by the Ministry of Energy and Ontario Hydro to the recent studies of East-West and of North-South exchanges of power. A copy of the report on the East-West study sponsored by the Interprovincial Advisory Council on Energy, was made available to your Commission's library. A final report on the U.S.-Canada power exchange study is expected to be available by late March, and a copy will be sent to your library.

By the way of final comment, I should say that the Government supports the concept of having a reasonable value placed upon Ontario Hydro's interconnections with other power systems in Canada and the U.S., a value which can be quantified in the context of the required system reserve margin for Ontario Hydro.

I am enclosing for your information a copy of a letter dated February 22, 1979, from the Minister of Energy to the Chairman of the Select Committee on Ontario Hydro Affairs, with respect to Government policy on the export of electric power by Ontario Hydro.

Yours sincerely,

Malcolm Rowan

Malcolm Rowan

c.c. The Honourable James A.C. Auld

APPENDIX F

Ontario

Office of the Minister

Ministry of Energy

416/965-4286
Telex
Enrgy Tor
06-217-880

Queen's Park
Toronto, Ontario

February 22, 1979

Mr. D.C. MacDonald
Chairman
Select Committee on Hydro Affairs,
Room 212
Legislative Building N.W.,
Queen's Park
Toronto, Ontario

Dear Mr. MacDonald:

In your letter of February 14, 1979, you requested a statement of current Government policy in relation to the export of electric power by Ontario Hydro. You also requested an explanation of any Government policy changes affecting the export of electric power that have been implemented during the past three years, or that are contemplated within the next two years.

Before answering your requests, it may be useful to provide you with some background information.

Ontario Hydro is not prohibited under The Power Corporation Act from exporting electric power. However, if it wishes to export electric power, Ontario Hydro first obtains the approval of the Lieutenant Governor-in-Council under section 70 of The Power Corporation Act and a licence from the National Energy Board under sections 81 to 83 of the National Energy Board Act.

Ontario Hydro has exported large quantities of electric power over the years with the approval of the Lieutenant Governor-in-Council and the National Energy Board. For example, the gross revenues from Ontario Hydro's exports of electric power in 1978 amounted to approximately $285-million. The net revenues from such sales are used to offset the revenue requirements of Ontario Hydro thereby benefitting the Ontario electrical consumer.

.../2.

Ontario Hydro's export sales of electric power to date have been made under inter-connection agreements which Ontario Hydro has with utilities in New York and Michigan. Among other things, the inter-connection agreements provide a mechanism for Ontario Hydro to export electric power produced from its unused reserve generating capacity. Ontario Hydro may interrupt the flow of electric power being sold by it under the inter-connection agreements at any time if it or any other Canadian utility requires the electric power.

The Government's basic policy is to approve the export of electric power by Ontario Hydro where the quantities proposed for export are surplus to Ontario and Canadian needs.

Following Ontario Hydro's significantly reduced 1978 load forecast, it became apparent that Ontario Hydro would likely have more generating capacity available in the early to mid-1980s than it would require to meet its forecast demand with an adequate margin of reserve. Accordingly, the Cabinet requested Ontario Hydro to explore the possibility of marketing, on either an interruptible or a firm basis, the electric power which could be produced from this surplus generating capacity. Following receipt of this request, Ontario Hydro initiated discussions with other Canadian and American utilities. These discussions have been exploratory only and Ontario Hydro has not presented a contract proposal to the Government for its approval.

Given the changed circumstances arising out of Ontario Hydro's significantly reduced 1978 and 1979 load forecasts, the Government will look positively at all proposals presented to it by Ontario Hydro for the export of electric power, including proposals for firm exports, which promise to provide a benefit to the Ontario electrical consumer. In reviewing such proposals, the Government will, of course, take into account the broader effects on Ontario of the proposed exports. It is premature to say on what terms and conditions the Government would approve a proposal by Ontario Hydro for the firm export of electric power.

.../3.

The basic policy of the Government with respect to the export of electric power has not changed and is not expected to change. Exports will be undertaken only if foreseeable Ontario and Canadian needs are secure.

Yours sincerely,

James A.C. Auld

EXTRACT FROM

STATEMENT TO THE LEGISLATURE

by

HON. REUBEN BAETZ, LL.D.

MINISTER OF ENERGY

on

ONTARIO HYDRO'S CONSTRUCTION PROGRAM 1978 - 1987

APRIL 17, 1978

In addition, the Government is requesting Ontario Hydro to begin negotiations with other Canadian and U.S. jurisdictions to develop potential export markets in order to capitalize on the remaining surplus capacity which will result from this revised generation program, particularly during the period 1981-85.

While our policy not to build generating capacity solely for export markets has not changed, I hardly need to remind the Members of this House, Mr. Speaker, that Hydro earned about $200 million gross revenue from the export of electric power in 1977 resulting in a benefit to electrical consumers through reduced electric power bills in 1977 and 1978.

This modification to Ontario Hydro's construction program reflects the realities we face in these uncertain times -- realities of reduced demand, lower economic growth, and related higher unemployment. It reflects the need for Ontario Hydro to maintain a diversified fuel capability and a production flexibility in anticipation of an improving economic climate.

Most of all, this modification reflects the confidence this Government has in the future of this Province and the strength which we have gained in the past from having abundant and relatively inexpensive electrical energy.

Recommendation

III-21 ONTARIO HYDRO ASSIGN A REASONABLE VALUE TO THE INTERCONNECTION SYSTEM IN PLANNING THE NEW GENERATION REQUIRED TO MEET THE RELIABILITY STANDARD.

RESPONSE - ACCEPTED

Recommendation

III-22 ONTARIO HYDRO CHANGE ITS PLANNING PROCESS TO EMPHASIZE MEETING ONTARIO'S ELECTRICAL ENERGY NEEDS AFTER IMPLEMENTATION OF CONSERVATION AND LOAD MANAGEMENT PROGRAMS, WITH THE MINIMUM AMOUNT OF NEW GENERATION THAT IS CONSISTENT WITH SOUND PLANNING.

RESPONSE - ACCEPTED

The Minister of Energy has directed Ontario Hydro to emphasize in its planning process the meeting of Ontario's electrical energy needs after implementation of conservation and load management programs have been taken into account.

Recommendation

III-23 ONTARIO HYDRO ACCEPT THE COMMITTEE'S EARLIER RECOMMENDATIONS AND FURTHER REDUCE ITS TARGETS FOR ADDING GENERATION IN THE NEXT TEN YEARS.

RESPONSE - REJECTED

In January 1976, Ontario Hydro was directed by the Government to limit its demands on the capital markets for 1976, 1977 and 1978 to $1.5 billion a year. This resulted in Ontario Hydro deferring its system expansion program and means that Hydro will limit its system expansion rate to 6% versus an historic growth in electrical demand of 7%.

REPORT ON THE NEED FOR ADDITIONAL BULK POWER FACILITIES IN EASTERN ONTARIO

E R R A T A

Section	Page	Printed as	Should read
	ix	rates initially at	rated initially at
II	9	723 MW	734 MW
IV	23	consequently, now only	consequently, not only
V	41	their forecasts usually has to be based	their forecasts usually have to be based
VIII	68	Al Watson of Ottawa Hydro	Al Watson of Ontario Hydro
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